RAPPAHANNOCK AREA DEVELOPMENT COMMISSION

ALL-HAZARDS MITIGATION PLAN

Submitted to:

Rappahannock Area Development Commission
P.O. Box 863
Fredericksburg, Virginia 22404

Submitted by:

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Chantilly, Virginia

March 2006

ACKNOWLEDGEMENTS

The Rappahannock Area Development Commission (RADCO) would like to acknowledge the participation and service of the local and regional representatives that assisted with the development of this plan. A two-tiered committee system was utilized to facilitate the plan's development. The Hazard Mitigation Coordinating Committee (HMCC), comprised of RADCO staff, local emergency management staff, and local planning staff, provided day-to-day plan development guidance and draft review. The larger Hazard Mitigation Planning Committee (HMPC), which included Coordinating Committee members as well as other local and regional organization representatives, participated in each of the seven facilitated plan development meetings, providing local and regional guidance in the development of both regional planning priorities and local priorities and strategies. RADCO Executive Director Stephen Manster facilitated the development of each committee. The committee rosters for each committee are listed below.

Hazard Mitigation Planning Committee

Stephen Manster, RADCO
Pat Quann, RADCO
Beth Payne, RADCO
Kerry Maloney, Spotsylvania County
Richard Goss, Spotsylvania County
Doug Boggs, Spotsylvania County
Mike Finchum, Caroline County
Matt Stafford, Caroline County
Edward Fuzy, Caroline County
Mark Bledsoe, City of Fredericksburg
Eddie Allen, City of Fredericksburg
Ray Ocel, City of Fredericksburg
Philip K. Brown, City of Fredericksburg
Wendy Shepherd, King George County
Jack Green, King George County
Kyle Conboy, King George County
Chuck Thompson, Stafford County
Mary Durrance, Stafford County
Steve Hubble, Stafford County
John Rayman, Dominion Power
John Howe, Virginia Cooperative Extension
Tom Snoddy, Virginia Department of Forestry
Dan Stamp, Virginia Department of Forestry
Karen Snape, Virginia Department of Forestry
Lisa Krajewski, Virginia Department of Forestry
Brian Wolfe, Rappahannock Electric Cooperative
Dean Gossett, Virginia Department of Environmental Quality
Bruce Sterling, Virginia Department of Emergency Management
Carol Shelton, NOW Area Dahlgren, VA/PAO, U.S. Navy
Joe Saitta, Rappahannock Area Health District

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Philip K. Brown, City of Fredericksburg
Wendy Shepherd, King George County
Jack Green, King George County
Chuck Thompson, Stafford County
Mary Durrance, Stafford County
Bruce Sterling, Virginia Department of Emergency Management

EXECUTIVE SUMMARY

The region represented by the Rappahannock Area Development Commission (RADCO) is vulnerable to a number of natural hazards including the effects of flood and wind damage caused by hurricanes, northeasters, winter storms, and tornadoes. Fresh in the minds of the residents of the RADCO region is the most recent natural disaster, Hurricane Isabel, which hit in September of 2003. The Pentagon attack on September 11, 2001 is also very pertinent to this region and its future planning initiatives.

For the most part, the last 50 years have been relatively free of disasters throughout the RADCO region. However, the last few decades of exponential growth within the region have placed more development in the way of potential disasters. This increases the potential for severe economic and social consequences if a major disaster or other catastrophic event were to occur. Such an event could cost the city and county governments, residents, and businesses millions of dollars in damages to public buildings and infrastructure, lost tax revenues, unemployment, homelessness, and emotional and physical suffering for many years to come.

The RADCO All-Hazards Mitigation Plan has been constructed in accordance with the requirements of the Disaster Mitigation Act of 2000 (DMA 2000) and will provide the communities and its citizens with a better understanding of the natural hazards the communities face, the assets vulnerable to those hazards, and the strategies available to mitigate those hazards. The plan will also help the communities build support for mitigation activities, develop more effective public education policies regarding mitigation and disasters, integrate mitigation processes into other community programs and processes and post-disaster recovery activities, and obtain disaster related grants in the aftermath of a disaster.

The Hazard Mitigation Planning Committee (HMPC) analyzed and prioritized the natural hazards that threaten the RADCO region. The Plan focuses on the hazards that have the highest probability of occurring. The HMPC considered and analyzed the potential impacts of these hazards, which were listed in the Plan's Vulnerability Assessment section. The HMPC also evaluated current capabilities in mitigating certain types of hazards; this evaluation went into the Capability Assessment section of the plan. The Hazard Identification, Vulnerability Assessment, and the Capability Assessment sections all compose the Risk Assessment section of the document. After reviewing the Risk Assessment, the HMPC assembled and developed goals, objectives, and possible mitigation strategies. With the developed list of mitigation strategies, the Committee prioritized those strategies and made recommendations as to the actions that would be appropriate given the potential strategies. This process formed the basis for this All-Hazards Mitigation Plan.

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List of Acronyms

Acronym	Definition
BFE	Base Flood Elevation
CRS	Community Rating System
DMA 2000	Disaster Mitigation Act of 2000
VDOF	Virginia Department of Forestry
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flood Mitigation Assistance Program
GIS	Geographical Information System
HIRA	Hazard Identification and Risk Assessment
HMGP	Hazard Mitigation Grant Program
HRPDC	Hampton-Roads Planning District Commission
MLLW	Mean Lower Low Water
NFIP	National Flood Insurance Program
NGVD	National Geodetic Vertical Datum
NOAA	National Oceanic Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NWS	National Weather Service
PDM	Pre-Disaster Mitigation Program
SFHA	Special Flood Hazard Area
STAPLE/E	Social, Technical, Administrative, Political, Legal, Economic, and Environmental
SLOSH	Sea, Lake and Overland Surges from Hurricanes
USACE	United States Army Corps of Engineers
USGS	United States Geological Society
VEC	Virginia Employment Commission
VDEM	Virginia Department of Emergency Management

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1.0 INTRODUCTION

The Disaster Mitigation Act of 2000 (DMA 2000), approved by Congress and signed into law (Public Law 106-390) in October 2000, is a key component of the Federal government's strategy to reduce the rising cost of disasters in the United States. The Act establishes the Pre-Disaster Mitigation Program (PDM) and new requirements for the post-disaster Hazard Mitigation Grant Program (HMGP). The Act's requirements emphasize the importance of mitigation planning at the local level.

In an effort to highlight the importance of planning in the mitigation process, the DMA 2000 law requires local governments to develop and submit natural hazard mitigation plans in order to qualify for PDM and HMGP grant funding. Specifically, the Act requires that the plan demonstrate "a jurisdiction's commitment to reduce risk from natural hazards, serving as a guide for decision makers as they commit resources to reducing the effects of natural hazards." The final plan must be adopted by the jurisdiction and then approved by the Federal Emergency Management Agency (FEMA) in order for communities to remain eligible for HMGP funding and to become eligible for PDM funding for future mitigation planning and project implementation.

In order to facilitate DMA 2000 compliance for its member jurisdictions, the Rappahannock Area Development Commission (RADCO), in conjunction with its member jurisdictions and other regional agencies and area constituents, developed this All-Hazards Mitigation Plan pursuant to the requirements of DMA 2000. This plan covers both natural and human-caused hazards. The main document addresses the natural hazards in the RADCO region. The Human-Caused Hazards Mitigation Plan, presented as Annex A of this document, was created by a planning process similar to the one required for natural hazards and addresses the region's human-caused hazards. While a plan addressing human-caused or man-made hazards is not currently required under the current DMA legislation, the Hazard Mitigation Planning Committee (HMPC) made the decision to cover these human-caused hazards through one integrated planning process. Because this plan contains information that is sensitive to the overall security of the region, it was not distributed to the general public. See Annex A for contact information. The HMPC's mitigation planning process also incorporated steps to meet the requirements of the Flood Mitigation Assistance (FMA) program, which will qualify its member jurisdictions for additional federal flood mitigation assistance.

Hazard Mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to human life and property from hazards. Planning is the process of setting goals, developing strategies, and outlining tasks and schedules to accomplish these goals. In preparing this plan, the HMPC identified natural hazards that threaten its member jurisdictions; ranked these hazards; determined the likely impacts of those hazards; assessed the vulnerability of its communities to the studied hazards, as well as the region's current capability to address those hazards; set mitigation goals; and determined and prioritized appropriate strategies that would lessen the potential impacts of hazard events.

1.1 Scope

The RADCO All-Hazards Mitigation Plan is a multi-jurisdictional plan that identifies goals, information, and measures for hazard mitigation and risk reduction to make its communities more disaster resistant and contribute to the region's long-term sustainability. The plan not only addresses current concerns, but will also guide and coordinate mitigation activities and local policy decisions for future land use. FEMA has encouraged communities throughout the United States to incorporate hazard mitigation planning into the local comprehensive planning process through the development of local and regional hazard mitigation plans. As communities make decisions on future growth, development, and land use, the incorporation of hazard mitigation

analysis into the process promises to reduce future damages from the natural hazards that will inevitably occur over time, and thus avoid future loss of life and property damage.

This Plan follows FEMA's DMA 2000 planning requirements and associated guidance for developing Local Hazard Mitigation Plans. This guidance sets forth a four-task mitigation planning process: 1) organize resources, 2) assess hazards and risks, 3) develop a mitigation plan, and 4) evaluate your work. The plan also utilizes the process set forth in FEMA's Crosswalk Reference Document for Review and Submission of Local Mitigation Plans.

1.2 How to Use This Document

The RADCO All-Hazards Mitigation Plan has been developed as a regional mitigation plan. The natural hazards analysis in the main body of the plan, as well as the human-caused hazard analysis in Annex A, followed the planning process outlined in Section 3.0. Section 4.1 of this plan identifies each of the natural hazards that the region faces and provides some background and descriptive history of the hazards across the RADCO region. Section 4.2 provides jurisdiction-specific profiles of the hazards that are considered most critical. Each jurisdiction's vulnerability to those hazards based on historical occurrence and other evidence of risk is assessed in Section 5.0. Jurisdiction-specific capability assessments, designed to demonstrate the mitigation tools and capabilities that each jurisdiction may employ, is presented in Section 6.0. Each jurisdiction-specific section has been designed to allow for each jurisdiction's review and acceptance, independent of the material in the remainder of the plan that applies to the entire region. Section 7.0 of the plan outlines broad, region-wide mitigation goals, objectives, and strategies, while also providing jurisdiction-specific mitigation goals, objectives, and strategies. Finally, Section 8.0 provides plan implementation and maintenance information that applies across the region as each community updates its material in this plan and implements mitigation projects that follow the priorities and objectives set forth in this planning effort.

Of note, each jurisdiction's elected leadership will be asked to adopt the portions of the plan that apply region-wide and those portions that apply specifically to each respective jurisdiction. Each jurisdiction will then be responsible for updating and maintaining the plan document. The DMA regulations require that the jurisdictions formally review their plans at least once every five years, coinciding with specifications in the Code of Virginia that call for local Comprehensive Plan review at least every five years. Many communities across the country that have developed hazard mitigation plans have found that more frequent updates are often warranted based on the occurrence of natural disasters and subsequent shifts in hazard mitigation priorities.

2.0 REGIONAL PROFILE

2.1 Location and Geography

The RADCO region, aligned geographically with the Fredericksburg area, is located in northeastern Virginia and includes the City of Fredericksburg and the Counties of Caroline (including the Towns of Bowling Green and Port Royal), King George, Spotsylvania and Stafford (Figure 2a). Neighboring communities are presented in Figure 2b. The 1,400 square mile region surrounds the fall line of the Rappahannock River, the transitional area from the Virginia Northern Piedmont eastward into the Virginia Coastal Plain.

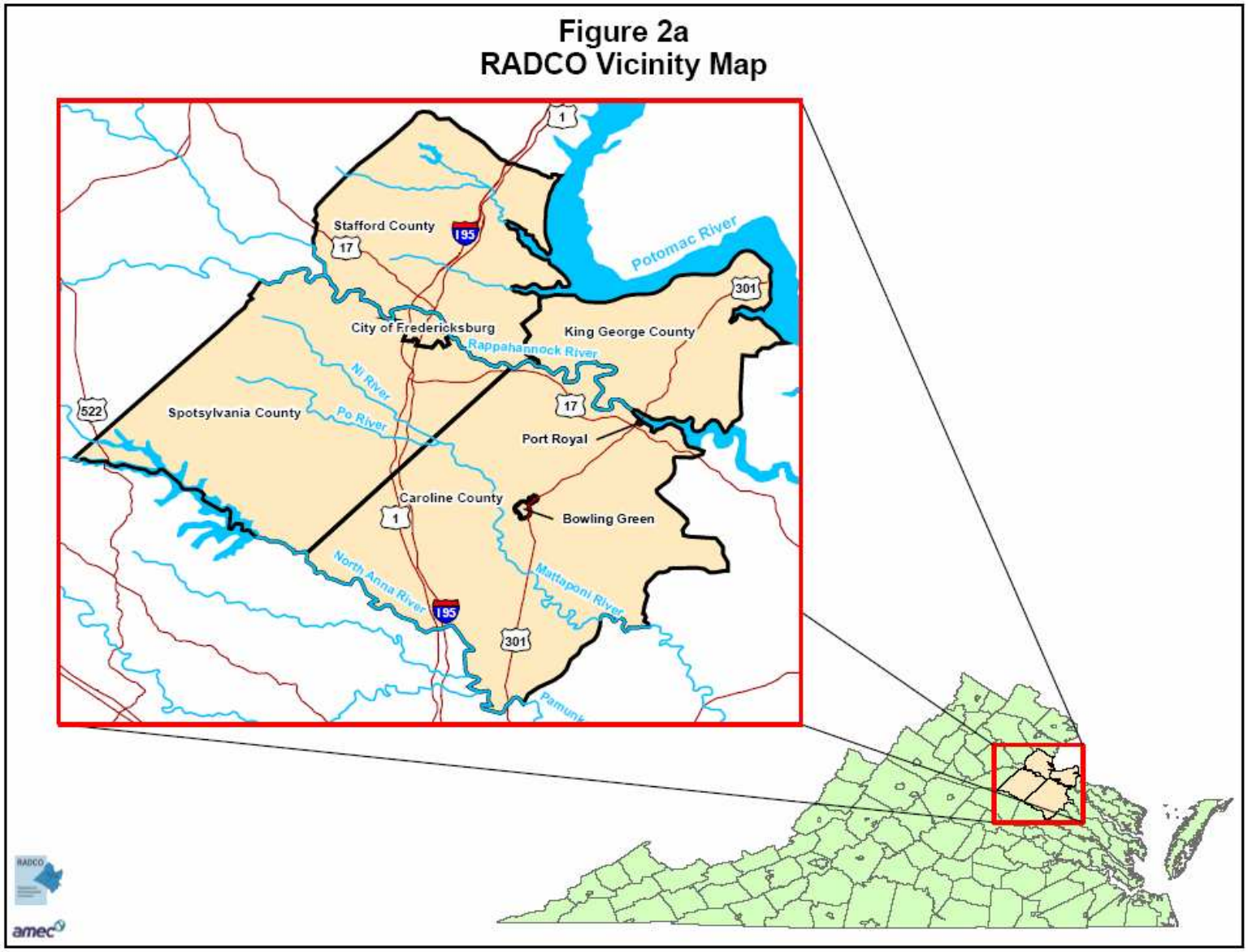
The RADCO region has been Virginia's fastest growing region for nearly three decades. In 2001, the population of the area was greater than 250,000. Regional growth has remained strong due in part to the region's relative proximity to the Washington, D.C area. Each of the RADCO region's jurisdictions, with the exception of Caroline County, is included in the Washington, D.C. Primary Metropolitan Statistical Area (PMSA), a variation on the traditional Metropolitan Statistical Area (MSA) designation that the U.S. Census Bureau instituted in 1993. Despite its rapid growth, the RADCO region continues to retain a special character and offer a high quality of life by offering residents a lower cost of living relative to other portions of the Washington, D.C. area along with a strong, local economic base and a variety of cultural and recreational opportunities.

Interstate 95 follows the fall line that divides the RADCO region into two distinct physiographic regions, the Northern Piedmont and the Coastal Plains. The Piedmont is a rolling to hilly landscape comprising the western portions of Spotsylvania and Stafford Counties. The level Coastal Plain covers sections of eastern Spotsylvania and Stafford Counties, the majority of Caroline County and the entirety of King George County.

The RADCO region contains portions of three major Virginia riverine watersheds: the Potomac, the Rappahannock, and the York. The upper reaches of each watershed are typical Piedmont uplands with streams and rivers flowing across the fall line on their way to the Chesapeake Bay. Tidal marshes and flats are common throughout the lower portions of the major Chesapeake Bay tributaries.

There are several predominant soil types found within the Region. Because the area covers several major physiographic regions, each has a different set of soil characteristics and properties. The red and yellow clays of the Piedmont uplands are predominant in the western portions of the region, giving way to the sandy loam and sandy clay loams of the coastal plains as one moves east in the RADCO region. The intermediate fall line zone has a combination of both soil types.

Figure 2a
RADCO Vicinity Map



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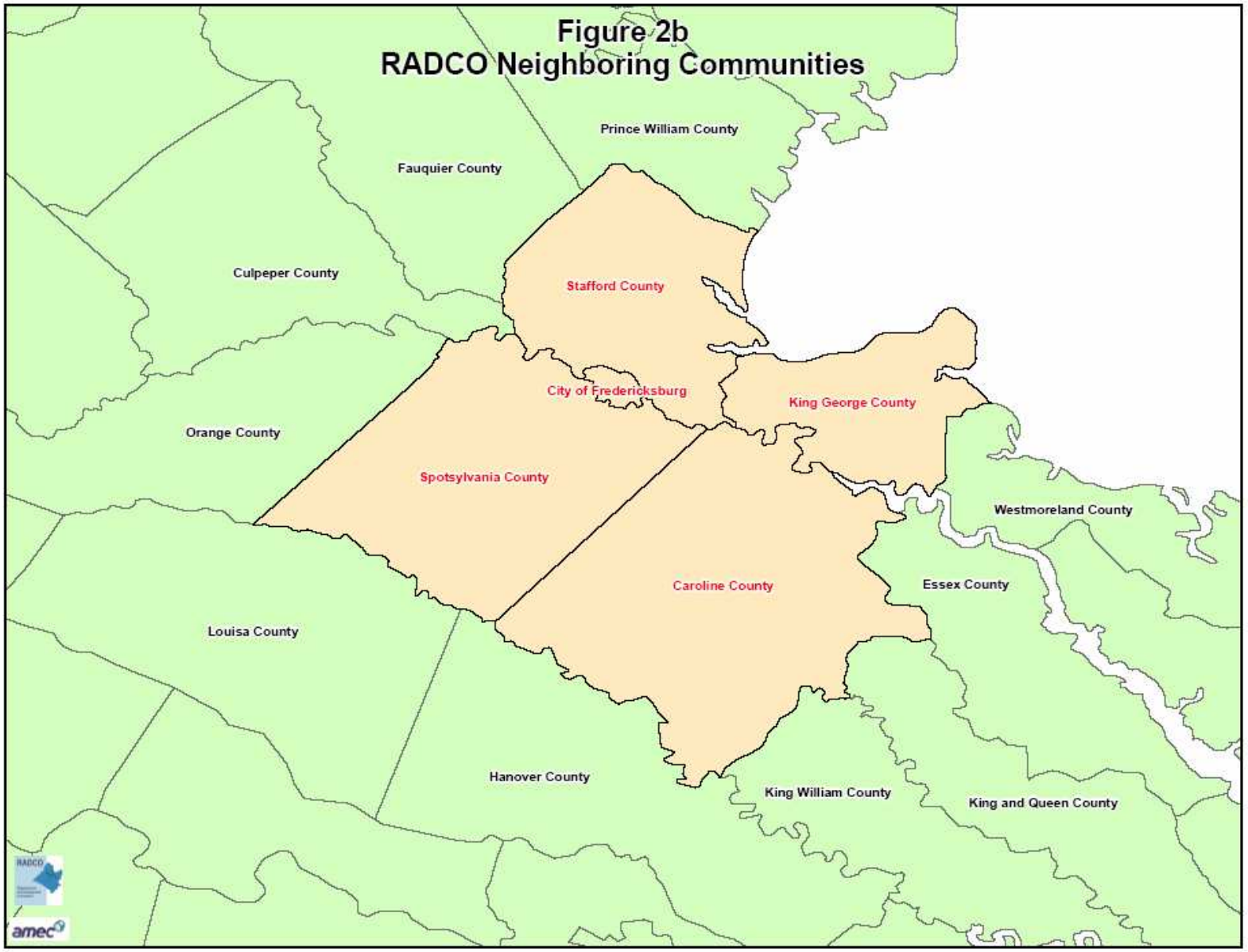

2.2 Population

As previously mentioned, the RADCO region has been Virginia's fastest growing region for almost 30 years. Between the 1990 and 2000 Census counts, the region grew by over 41 percent (see Table 2.0). Recent population estimates completed by the Weldon Cooper Center for Public Service at the University of Virginia show that the region continues to grow at a rapid pace. The RADCO region's dynamic growth over the past three decades is due, in part, to its strategic location in the Washington, D.C. metropolitan area and transportation access to the eastern seaboard. The region, located in the heart of the east coast's urban corridor, is centrally located between Washington, D.C. to the north and the Virginia capital, Richmond, to the south. It has proven to be a profitable location for a wide range of both national and international companies.

Table 2.0
Regional Population Statistics

Jurisdiction	1990 Census	2000 Census	Percent Increase '90 – '00
Caroline County - Town of Bowling Green - Town of Port Royal	19,217	22,121	+15%
City of Fredericksburg	19,027	19,279	+1%
King George County	13,527	16,803	+24.2%
Spotsylvania County	57,403	90,395	+57.5%
Stafford County	61,236	92,446	+51%
RADCO Region Total	**170,410**	**241,044**	**+41.4%**

Source: City of Fredericksburg, 2005. Compiled by AMEC.

2.3 History of the RADCO Region

Caroline County

Caroline County was created in 1727 through the division of portions of King William, King and Queen, and Essex Counties. Caroline County was named for Caroline, the wife of King George II of England. Like each of the RADCO jurisdictions, Caroline County holds a wide variety of both Virginian and American history. Among its most notable historical figures, the County claims George Rogers Clark as a native son. Clark, along with Merriweather Lewis and the Corps of Discovery, opened the newly purchased Louisiana territory in 1803-1804. Clark's, manservant, York, one of the more highly acclaimed members of the Corps of Discovery was also a Caroline County native.

During the Civil War, more than one million men marched or camped in Caroline County. Confederate troops, under the command of General George E. Pickett fought Union troops near Milford in 1864. Confederate General Stonewall Jackson died in Guinea after mistakenly being shot by his Confederate troops at Chancellorsville. John Wilkes Booth, the assassin of President Lincoln, was allegedly shot by federal troops in Caroline County.

Caroline County covers roughly 549 square miles and remains primarily rural. The County has two incorporated towns: Bowling Green, the County seat; and the historic Town of Port Royal. The County also hosts the United States Army's Fort A.P. Hill, a 76,000 acre installation that provides year round administrative and logistical support and training for the U.S. Army's Active Army, reserves, and other

branches of the military and the U.S. Government. Caroline County is located within 30 miles of the City of Richmond, Virginia.

Town of Bowling Green

The Town of Bowling Green, with a population of 766, has been the County seat of Caroline County since 1803. It is located 72 miles south of Washington, D.C., 108 miles southeast of Baltimore, Maryland and 35 miles north of Virginia's Capital, Richmond. The Town traces its origins back to the 1670's, when Major John Hoomes established his "Bowling Green" plantation under charter from the English Crown. The Town's history includes three centuries of colonial and modern Virginia development. The Town has hosted such notable historical figures as George Washington and the Marquis de Lafayette. Union General Ulysses S. Grant occupied Bowling Green during the Civil War (1864) and John Wilkes Booth, assassin of President Abraham Lincoln, was apprehended in a farmhouse near the town in 1865. Bowling Green has a well-documented historic district highlighted by the Old Mansion, a brick dwelling that dates back to the 17th Century.

Town of Port Royal

The Town of Port Royal was settled in 1652 when John Catlett and his half brother, Ralph Rowzee patented 400 acres. The Town was once the only chartered town in Caroline County, and is the County's oldest incorporated town. An important colonial shipping port for tobacco to Britain, it later served as a warehouse center and mover of grain, freight, and passengers on three-masted schooners. Traces of this colorful past can still be found today in the historic Town of Port Royal, all of which is listed on the National Register of Historic Places.

City of Fredericksburg

Fredericksburg is an independent city situated along the Rappahannock River and bordered by Spotsylvania and Stafford Counties. The City was founded in 1728 and named after Prince Frederick Louis of Wales, the father of King George III of England. Fredericksburg was incorporated as a town in 1781 and became an independent city in 1879. The historic part of the city itself only covers 40 square blocks, but the City of Fredericksburg encompasses 10 square miles. The historic district has over 350 original buildings built before 1870. The Fredericksburg area was the boyhood home of young George Washington, James Monroe practiced law here, and Thomas Jefferson also lived in the City. Many Civil War battles were fought in or near the City, including the Battle of Fredericksburg in 1862. The City changed hands between the Union and Confederate Armies on several occasions.

The City of Fredericksburg is located just one hour south of Washington D.C. and 45 minutes north of the City of Richmond. Though the City itself only covers approximately 10 square miles, growth and development have occurred in the urbanizing areas surrounding the City. Fredericksburg is closely linked to Stafford and Spotsylvania Counties both of which spread out many miles in all directions. The Fredericksburg, Spotsylvania, and Stafford area is one of the fastest-growing areas in the Commonwealth and is one of the top 20 in the nation.

King George County

King George County, named for King George I of England, was formed in 1720 from Richmond County. Known as the "Gateway to the Northern Neck," King George County is home to 19,355 (2004 population estimate) citizens. Like the other jurisdictions in the region, King George County's roots are deeply imbedded in both the founding of the country and in its rural past. The County is a little over 183 square miles (113,920 acres), of which 72,718 acres are forested, and 38,105 acres are agricultural. Both the Potomac and the Rappahannock Rivers border the County. The County's location, near both the Washington and Fredericksburg urban areas, and the serenity of Virginia's scenic Northern Neck offer a

unique and vivid perspective of an emerging Virginia. Among the County's claims to fame, King George is home to St. Paul's Episcopal Church where George Washington attended services as a youth and where James Madison, the Country's fourth president, was born. Agriculture continues to be an economic anchor in King George County, but because of the County's proximity to the Washington D.C. and Fredericksburg areas and its two major thoroughfares (State Route 3 and U.S. Route 301), a growing state of the art fiber optics and telecommunications network is developing in the County. King George County is also the host community to one of the world's premier research and development centers, the Naval Surface Warfare Center at Dahlgren, the region's largest employer.

Spotsylvania County

Spotsylvania County, named after Alexander Spotswood, Colonial Governor of Virginia, was formed in 1721 and has played host to a wide variety of Virginia's history. Much of Spotsylvania County's early development is attributed to Spotswood's ironworks founded in the early 1700's. Spotswood's "Iron Mines Company," a mining and smelting operation, was founded in 1725 at Germanna. This was the first fully equipped iron furnace in the colonies and was Spotsylvania County's first industry. A blast furnace, also founded by Spotswood, was operated in this area from 1730 through 1785. Remnants of the ironworks are still found in the County. Under Spotswood's resourceful leadership, a road network for transporting the iron was laid out, and skilled laborers to build the roads were imported from Germany. Upon his death in 1740, Spotswood left behind a nearly self-sufficient iron empire that set in motion the rise of America's iron and steel industry. Spotswood's furnace was acquired in 1842 by the United States Government, which set up a forge and foundries. Here, the government made hundreds of cannons to supply the army in the Mexican War. At that time, it was one of the most important cannon works in the country.

Four major Civil War battles were fought on Spotsylvania County soils, including one of the bloodiest of the war, the Battle of Spotsylvania Court House in May 1864. Here the armies of Ulysses S. Grant and Robert E. Lee participated in one of the most intense clashes in American history: the Union attack on the Confederate-held "Bloody Angle." This battle marked the beginning of the fall of the Confederacy. It was in Spotsylvania County, at the Battle of Chancellorsville, that Stonewall Jackson fell to the misguided fire of his own men. The National Park Service maintains more than 4,400 acres of the Civil War battlefields in various locations throughout Spotsylvania County.

Stafford County

Like each of the jurisdictions in the RADCO region, Stafford County has been home to a wide variety of Virginia's history. Captain John Smith explored the Chesapeake Bay region from Jamestown to present-day Stafford. The legendary Indian princess, Pocahontas, was kidnapped from Stafford's Marlborough Point. The Brents of Maryland established the first English Catholic settlement in Virginia, on Aquia Creek, and opened it to all faiths. All of this took place before Stafford County was formally established in 1664.

Stafford's fisheries, tobacco plantations, iron works and flourmills were major suppliers of Great Britain in the Colonial period. George Washington and George Mason lived in Stafford as youngsters. James Hunter's Iron Works was one of the major industrial plants in the Revolutionary era and supplied the colonial army with arms in its fight for independence. Aquia sandstone provided stone for the White House, the U.S. Capitol, and trim for private homes. In addition, Stafford's Anthony Burns was the subject of America's first major fugitive slave case.

During the Civil War, the bloody Battle of Fredericksburg took place across the banks of the Rappahannock River in December 1862. Chatham Manor, in Stafford County, was used as the Union headquarters and a hospital to treat the wounded. It was in Stafford, the next spring that Union General

Hooker bogged down his army on the famous “Mud March,” on his way to another Union defeat at the Battle of Chancellorsville.

The citizens of Stafford might have been the first in the world to suffer the devastating effects of a modern war, having hosted the entire Union Army from 1862-1863. Over 125,000 men (more than today’s County population) had to be housed, fed, warmed and entertained, straining the County’s resources to the point of collapse.

Prosperity did not return until World War I when the U.S. Marine Corps came to Quantico. At that time, the County was primarily agricultural, with the exception of fishing industries situated along the Potomac River. In World War II, the wide expansion of the Marine Corps base created new employment opportunities. A Civilian Conservation Corps camp was located in Southern Stafford during this time.

With the completion of I-95 in the 1960’s and the recent addition of commuter rail, Stafford is one of Virginia’s fastest growing localities.

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3.0 THE PLANNING PROCESS

The Rappahannock Area Development Commission retained AMEC Earth & Environmental, Inc. (AMEC) to assist with the facilitation and development of the region's All-Hazards Mitigation Plan. AMEC staff, a combination of professional mitigation experts, planners, and engineers, assisted RADCO with the following tasks/processes:

- Establishment of a two-tiered committee structure to assist with the organization and development of the RADCO All-Hazards Mitigation Plan;
- Fulfillment of all DMA requirements as established by federal regulations, following FEMA's planning guidance;
- Facilitation of the planning process;
- Identification of the data requirements and documentation necessary to augment that data;
- Development and facilitation of the public input process;
- Production of the draft and final plan documents; and
- Submission for acceptance by the Virginia Department of Emergency Management (VDEM) and FEMA Region III.

AMEC assisted RADCO with the establishment of the process for this planning effort, utilizing the DMA 2000 planning requirements and FEMA's associated guidance. This guidance is structured around a broad, four-phase approach. AMEC's planning process incorporated another 10-step planning process that satisfies the planning requirements of several other federal programs, including FEMA's Flood Mitigation Assistance (FMA) program and flood control projects authorized by the U.S. Army Corps of Engineers. The process employed in this plan assisted the HMPC with planning for the mitigation of both natural hazards and human-caused hazards. The approach for the planning process followed the steps presented in Table 3.0 below.

Table 3.0
DMA and FMA Planning Cross Reference

Disaster Mitigation Act Planning Regulations (44 *CFR* 201.6)	FMA Planning Steps
1.0 Planning Process	
201.6(c)(1)	1. Get Organized
201.6(b)(1)	2. Plan for Public Involvement
201.6(b)(2) & (3)	3. Coordinate with other Departments and Agencies
2.0 Risk Assessment	
201.6(c)(2)(i)	4. Assess the Hazard
201.6(c)(2)(ii) & (iii)	5. Assess the Problem
3.0 Mitigation Strategy	
201.6(c)(3)(i)	6. Set Planning Goals
201.6(c)(3)(ii)	7. Review Possible Mitigation Activities
201.6(c)(3)(iii)	8. Draft an Action Plan
4.0 Plan Maintenance	
201.6(c)(5)	9. Adopt the Plan
201.6(c)(4)	10. Implement, Evaluate, Revise

Local Government / Community Participation

The DMA planning regulations and guidance stress that each local government seeking the required FEMA approval of its mitigation plan must:

- Participate in the process;
- Detail areas within the Planning Area where the risk differs from that facing the entire area;
- Identify specific projects eligible for funding; and
- Ensure that the governing bodies adopt the plan.

To help define the participation process in this plan, AMEC assisted the RADCO staff with the identification of potential Hazard Mitigation Planning Committee members. See Appendix A for HMPC meeting agendas and meeting minutes. Participation by the committee was defined as follows:

- Attending the Hazard Mitigation Planning Committee meetings;
- Providing data that is requested by the Hazard Mitigation Planning Committee;
- Reviewing and providing comments on draft plans;
- Advertising, coordinating, and participating in the Public Input; and
- Coordinating plan adoption by the individual communities.

Step 1: Get Organized – Building the Planning Team

The Hazard Mitigation Planning Committee (HMPC) was comprised of key RADCO and local stakeholder representatives. The RADCO Executive Director chaired the HMPC. With the Committee's commitment to participate, AMEC's first step was to establish both a framework and organization for the development of this Plan. The Committee met nine times over an eleven-month period. Typical attendees of each meeting included representatives from local first response agencies, planning departments, public works, forestry, utilities and infrastructure, local emergency management personnel, and private industry. In addition, the Virginia Department of Forestry, private industry, as well as the Virginia Department of Emergency Management (VDEM) participated on the HMPC. Other governmental agencies participating in the meetings include representatives from the Virginia Department of Environmental Quality, the Virginia Department of Health, and the U.S. Navy. A list of HMPC members is included in the Acknowledgements section at the front of this Plan. Attendance and agendas for each of the HMPC meetings are on file at the RADCO office in Fredericksburg. While the HMPC was assembled to assist with the development of this plan, the committee structure may also facilitate updates of the plan over time as needed by the member communities and/or as required by the Act.

Step 2: Plan for Public Involvement – Engaging the Public

The planning process utilized in the development of this plan provided opportunities for the public and stakeholders to comment on the plan at two different stages in its formation. The draft hazard identification and risk assessment (HIRA) was provided to each jurisdiction and made available to the public through a variety of media, including local Internet web sites. Similarly, the final draft plan was made available to each community for public comment prior to the local adoption actions. At the initial HMPC meeting in October 2004, the committee discussed and agreed upon this plan for public involvement. Committee meeting schedules, minutes, and plan updates were also posted on the RADCO web site at http://www.radco.state.va.us/. All articles, press releases and Internet postings are on file with RADCO.

A series of five public presentations and listening sessions, one in Fredericksburg and one in each of the four counties in the region, was held to take comments on the draft Risk Assessment. Another five meetings were held allowing for public input on the Draft Plan. Two press releases were disseminated as well. One coincided with the presentation to the public of the draft plan, and the last coincided with the announcement of the Plan's adoption by all the communities within the RADCO region.

Step 3a: Coordinate with other Departments and Agencies

Early in the planning process, the Committee determined that the participation of other state and federal agencies would be beneficial in the data collection, mitigation and action strategy development, and plan approval process. Representatives from the following key agencies were invited to participate on the Committee:

- FEMA Region III (Mitigation Planning Division);
- Virginia Department of Forestry;
- Virginia Department of Emergency Management (Mitigation Planning Division);
- Virginia Department of Conservation and Recreation (Division of Dam Safety and Floodplain Management); and
- Rappahannock Area Health District

Neighboring communities and academic institutions were contacted directly and provided with the opportunity to review and comment on the plan. See Appendix A for correspondence.

In addition to the agencies listed above, the Committee used the resources of the agencies set forth below in the development of this Plan. Specifically, technical data, reports, and studies were obtained from these agencies either through web-based resources or through personal contact with the agencies.

- National Climatic Data Center (NCDC)
- Virginia Department of Emergency Management (VDEM)
- Virginia Department of Conservation and Recreation (DCR)
- Colorado State University, Tropical Meteorology Project
- Virginia Department of Health (VDH)
- National Oceanic and Atmospheric Association (NOAA)
- Federal Emergency Management Agency (FEMA)
- National Weather Service (NWS)
- U.S. Geological Survey (USGS)
- U.S. Census Bureau

Step 3b: Relationship to Other Community Planning Efforts and Hazard Mitigation Activities

Coordination with other community planning efforts is paramount to the success of a hazard mitigation plan. Hazard mitigation planning involves identifying existing community policies, tools, and actions that will reduce a community's risk and vulnerability to natural hazards. The Committee identified a variety of comprehensive planning mechanisms such as land use and master plans, emergency operations plans, and municipal ordinances and building codes that guide and control community development. Integrating existing planning efforts, mitigation

policies, and action strategies into this Hazard Mitigation Plan establishes a credible and comprehensive plan that ties into and supports other community programs. This Plan, therefore, links the specific natural hazards that present a risk to the community with the existing mitigation elements found in community programs, other planning documents, and regulations. The development of this Plan utilized information included in the following community plans, studies, reports, and initiatives:

- Municipal Comprehensive Plans from RADCO region localities
- Codified Ordinances from RADCO region localities
- Virginia Uniform Statewide Building Code - 2000
- Emergency Operations Plans from RADCO region localities
- Flood Insurance Study and Flood Insurance Rate Maps for the RADCO region
- RADCO region Tax Assessor and Land Use data

Step 4: Assess the Hazard

The HMPC conducted a Hazard Identification study to determine which hazards threaten the region. Research focused on previous occurrences of natural hazards, those that might occur in the future, and the likelihood of their occurrence or recurrence. The hazards identified and investigated in the RADCO region include:

- Biological Hazards / Epidemics;
- Dam Failure;
- Drought;
- Earthquakes;
- Expansive Soils;
- Extreme Heat;
- Flooding;
- Hurricanes;
- Landslide;
- Northeasters;
- Thunderstoms;
- Tornadoes;
- Wildfires; and
- Winterstorms.

Step 5: Assess the Problem

Once the hazard identification step was complete, the HMPC conducted vulnerability assessments to describe the impact that each identified hazard would have upon the RADCO region and its respective jurisdictions. The HMPC also conducted capability assessments to determine the current ability of each jurisdiction to mitigate the hazards through existing policies, regulations, programs, and procedures. The analyses identified areas where improvements could or should be made.

Step 6: Set Planning Goals

Planning goals were established to incorporate improvement areas identified in Step 5 into the Mitigation Plan. The HMPC set goals, formulated as public policy statements, that:

- Represent basic desires of the community;
- Encompass all aspects of the community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Additionally, goals from other community programs and priorities were identified and discussed. This Multi-Objective Management (MOM) assisted the HMPC in striving for efficiency by combining projects/needs from various community programs and plans that are similar in nature or location. Combining projects/needs through MOM effectively results in access to multiple sources of funding to solve problems that can be "packaged" and broadens the supporting constituency base by striving towards outcomes desired by multiple stakeholder groups.

Step 7: Review Possible Mitigation Activities

Following the goal setting meeting, the HMPC undertook a brainstorming session to generate a set of viable alternatives that would support the selected goals. The HMPC focused on the following categories of mitigation measures:

- Prevention;
- Property Protection;
- Structural Projects;
- Natural Resource Protection;
- Emergency Services; and
- Public Information.

A facilitated discussion examined and analyzed potential alternatives. Similar to the goal-setting activity, the HMPC included all previously recommended mitigation actions from existing mitigation plans in its review. After old and new mitigation actions had been identified, the HMPC members used a decision-making process recommended by FEMA to prioritize mitigation measures.

Step 8: Draft an Action Plan

The prioritized mitigation measures were further developed into an action plan that identifies the following for each measure:

- Responsible office;
- Priority (high, medium, or low);
- Cost estimate;
- Benefit to the community;
- Potential funding sources; and
- Schedule for completion.

Step 9: Adopt the Plan

Each jurisdiction within the RADCO region shall adopt the plan through its respective governing body.

Step 10: Implement the Plan, Evaluate its Worth, Revise as Needed

Step 10 is critical to the overall success of hazard mitigation planning. Upon adoption, the All-Hazards Mitigation Plan faces the truest test of its worth, implementation. Many worthwhile and high priority mitigation actions have been recommended. The HMPC must decide which action to undertake based upon priority and available funding.

In addition, the All-Hazards Mitigation Plan requires maintenance. There will be an ongoing effort to monitor and evaluate the implementation of the plan, and to update the plan as progress, roadblocks, or changing circumstances are recognized.

4.0 HAZARD IDENTIFICATION AND RISK ASSESSMENT (HIRA)

The hazard identification and risk assessment (HIRA) process provides information that allows a community to better understand its potential risk and associated vulnerability to hazards. This information provides the framework for a community to develop and prioritize mitigation strategies and to implement plans to help reduce both the risk and vulnerability from future hazard events. The HIRA followed the methodology described in FEMA publication 386-2 *"Understanding Your Risks – Identifying Hazards and Estimating Losses"* (FEMA, 2002) and was based on a four-step process:

1. Identify Hazards;
2. Profile Hazard Events;
3. Inventory Assets; and
4. Estimate Losses.

The HIRA covers Planning Steps 4: Assess the Hazard and Step 5: Assess the Problem. It also includes a third component, Capability Assessment, where the risk and vulnerability are analyzed in light of existing mitigation measures, for example, the adoption and enforcement of building codes, warning systems, and floodplain development regulations. The HIRA for the RADCO region was prepared in the following format:

REGIONAL HAZARD IDENTIFICATION

The HMPC conducted a hazard identification study to determine what hazards threaten the RADCO region and each local jurisdiction. Section 4.1 defines what the hazards are and gives a brief description of the historical occurrences of the hazards for the region as a whole. The hazard identification documents the previous occurrence of natural hazards, those that might occur in the future, and the likelihood of their occurrence or recurrence. At the end of this section is the discussion of critical vs. non-critical hazards that affect the region.

COMMUNITY SPECIFIC HAZARD IDENTIFICATION

Section 4.2 presents the community-specific sections where those natural hazards that affect each member jurisdiction differently are discussed.

REGIONAL VULNERABILITY ASSESSMENT

Section 5.1 describes vulnerabilities that are common to all communities within the RADCO region.

COMMUNTIY SPECIFIC VULNERABILITY ASSESSMENT

Section 5.2 presents the vulnerability assessments that were performed for each jurisdiction for critically identified hazards and the results of these analyses.

REGIONAL CAPABILITY ASSESSMENT

Section 6.1 presents State, Regional, and Federal mitigation capabilities that are common to all communities within the RADCO region.

COMMUNTIY SPECIFIC CAPABILITY ASSESSMENT

Section 6.2 describes each jurisdiction's capability to deal with the hazards from both a response and a policy capability. A capability assessment matrix (Table 4.0) was used for this purpose.

Table 4.0
Capability Assessment Matrix (Example)

Capability	Town of HAZARDVILLE
Comprehensive Plan	Yes
Land Use Plan	Yes
Subdivision Ordinance	Yes
Zoning Ordinance	Yes
NFIP/FPM Ordinance	Yes
-Effective FIRM Date	22-July-77
-Substantial Damage Language	Yes
- Certified Floodplain Manager	No
- Number of Floodprone Buildings	0
- Number of NFIP policies	0
- Maintain Elevation Certificates	No
- Number of Repetitive Losses	0
CRS Rating	No
Stormwater Program	Yes
Building Code Version	USBC 2000 Edition (based on IBC)
Full-time Building Official	Yes
- Conduct “As-built” Inspections	Yes
BCEGS Rating	TBD
Local Emergency Operations Plan	Yes
Hazard Mitigation Plan	
Warning Systems in Place	Yes
- Storm Ready Certified	No
- Weather Radio Reception	Yes
- Outdoor Warning Sirens	Yes
-Emergency Notification (R-911)	Yes
-other? (e.g., cable over-ride)	Yes-Cable-Emergency Alert System
GIS system	No
-Hazard Data	N/A
-Building footprints	N/A
-Tied to Assessor data	N/A
-Land Use designations	N/A
Structural Protection Projects	No
Property Owner Protection Projects	Buyouts
Critical Facilities Protected	No
Natural Resource Inventory	Yes
Cultural Resources Inventory	Yes
Erosion Control Procedures	Yes
Sediment Control Procedures	Yes
Public Information Program/Outlet	Yes
Environmental Education Program	Yes

In the Capability Assessment Matrix, a “Yes” means the Community provides the service; “No” means the Community does not provide the service; and a “TBD” or “In Progress” means the item or activity is either to be determined or in progress. Blank boxes or N/A (non-applicable) means the information was either unknown or unavailable.

EXPLANATION OF CAPABILITY ASSESSMENT MATRIX

Does the Community have the following:

Comprehensive Plan: A Comprehensive Long-Term Community Growth Plan.

Land Use Plan: A plan that designates type of Land Use desired/required; uses Zoning.

Subdivision Ordinance: A regulation that dictates the subdivision of parcels, lot sizes, density of development, setbacks, and often, construction type.

Zoning Ordinance: An ordinance that dictates types of Use and Occupancy, often a tool used for implementation of local Land Use Plan.

National Flood Insurance Program (NFIP)/Floodplain Management Ordinance: A Floodplain Management Ordinance directs development in identified Special Flood Hazard Areas. An ordinance is required for participation in the NFIP, which makes Federally backed flood insurance available to consumers.

Substantial Damage: Does the community's floodplain management ordinance contain language on Substantial Damage/Substantial Improvements?

Administrator: Does the community have a Floodplain Management Administrator (someone with the responsibility of enforcing the ordinance and providing ancillary services such as floodplain determinations from the community flood map, public education, etc.).

Number of Floodprone Buildings: How many buildings are in the mapped Floodplain?

Number of NFIP policies: How many buildings are insured against flood through the NFIP?

Number of Repetitive Losses: Number of repetitive, insured flood losses: (More than $1,000 paid in flood insurance claims twice in a 10 year period).

CRS Rating: Does the community participate in the NFIP's Community Rating System, and if so, what is the community's rating?

BCEGS: Building Code Effectiveness Grading System Rating.

EOP: A local Emergency Operations Plan, generally a disaster RESPONSE plan which includes a preparedness and recovery plan.

Hazard Mitigation Plan: Any plan that addresses natural or man-made hazards and includes measures for the mitigation of the hazards identified (may include local floodplain management plans).

Warning: Any type of system, such as "Storm Ready" Certification from the National Weather Service, NOAA Weather Radio reception, outdoor sirens, Cable (TV) Override, or an Emergency Warning Notification System?

GIS: A Geographic Information System

Structural Protection Projects: Levees, drainage facilities, detention/retention basins, or other structural flood protection or prevention infrastructure.

Property Protection Projects: Buy-outs, elevation of structures, floodproofing, small "residential" levees or berms/floodwalls designed to protect specific properties or structures.

Critical Facility Protection: Protection of power substations, sewage lift stations, water-supply sources, the local Emergency Operations Center (EOC), police/fire stations or medical facilities that are at risk.

Natural And Cultural Inventory: Does the community have an inventory of resources, maps, or special regulations within the community (i.e. wetlands and historic structures/districts, etc.)?

Erosion Or Sediment Control: Does the community have and enforce local or state regulations?

Public Information And/Or Environmental Education Program: Does the community have an ongoing program even if its primary focus is not hazards? Examples would be "regular" flyers included in community utility billings, a website, or an environmental education program for kids in conjunction with Parks & Recreation.

4.1 Regional Hazard Identification

The Hazard Mitigation Planning Committee conducted a hazard identification study to determine which hazards threaten the planning area's communities. The natural hazards identified and investigated in the RADCO region included the following:

- Biological Hazards/Epidemics;
- Dam Failure;
- Drought;
- Earthquakes;
- Expansive Soils;
- Extreme Heat;
- Flooding;
- Hurricanes/Tropical Storms;
- Landslides;
- Northeasters;
- Thunderstorms;
- Tornadoes;
- Wildfire; and
- Winter Storms.

Historical data was collected for all hazard types. By examining the historical occurrences of each hazard, along with the impacts, the HMPC was able to identify the hazards that pose the most significant risks to the region. This identification will allow the jurisdictions within the region to focus their hazard mitigation planning efforts on the hazards most likely to have an impact on the region in the future. Prioritizing the potential natural hazards that threaten the RADCO region required analysis of two factors: the probability that a certain type of natural hazard would affect the region and the potential extent and severity of the damage caused by that hazard. The probability of occurrence for each hazard was determined using existing technical analyses, such as the FEMA Flood Insurance Study. When data was not available, the probability was based on the history of events.

4.1.1 Biological Hazards/Epidemics

Biological hazards are caused by naturally occurring substances such as bacteria, fungi, molds and viruses. In many cases, these hazards are not visible, yet they can cause serious health problems for humans, plants and animals. Occurrences of West Nile Virus (WNV), Lyme disease, and bacterial epidemics have all been documented in the RADCO region within the last ten years (Table 4.1.1).

WNV emerged as a health threat in the United States in 1999. Since then, almost 10,000 people have become ill across the country. Humans contract the disease through mosquito bites, which usually causes little initial reaction from the bite. However, a small percentage of those infected develop mild symptoms that include fever, headache, body aches, skin rash and swollen lymph glands. Less than one percent of infected people develop a more severe illness that can include meningitis (inflammation of one of the membranes covering the brain and spinal cord) or encephalitis.

Lyme disease is a bacterial infection that can infect both humans and animals. It is most commonly transmitted to humans bitten by deer ticks. If Lyme disease goes untreated, some patients may develop arthritis, including intermittent episodes of swelling and pain in the large joints. In addition, patients may suffer from neurological abnormalities, such as meningitis, facial palsy, motor and sensory nerve inflammation and encephalitis. Cardiac problems, such as an enlarged heart and inflammation of the heart tissue, are also possible results of infection.

Bacteria and viruses can be a serious cause of water contamination and can have disastrous effects on the animals living within polluted waterways. In some instances, pollution from storm flooding can produce high levels of fecal coliform bacteria and viruses in rivers and streams. For example, in 1998 and 2003 large portions of the Rappahannock River were closed to shellfishing due to high bacteria counts in the river following local flooding events. Also, during the summer of 2004, a bacterial infection caused the deaths of millions of adult croaker fish along the coastline of Virginia.

An additional biological hazard of recent concern is avian influenza. Avian influenza is an infection caused by avian (bird) influenza (flu) viruses. Although these flu viruses occur naturally among birds, avian influenza is very contagious and can cause some domesticated birds to become ill with often fatal consequences. Bird flu viruses do not usually infect humans, however more than 100 confirmed cases of human infection with bird flu viruses have occurred worldwide since 1997. As of December 6, 2005, there have been no confirmed human cases of avian influenza in the United States.

Pandemic influenza is a worldwide outbreak of the influenza virus that occurs when a new strain of the influenza virus A emerges, to which few people in the world have a natural immunity. Pandemic flu would cause severe illness and would spread quickly, because of the human population's susceptibility. In the last century there were three pandemic influenza viruses (1918-19, 1957-58, and 1968-69). The most recent pandemic flu was the mildest and killed 34,000 people in the United States. While pandemics are difficult to predict, one strain of the avian flu described in the paragraph above is of concern to federal Health and Human Services and Centers for Disease Control and Prevention officials as a possible pandemic flu virus.

Past Occurrences

Table 4.1.1 presents historical biological hazard data for the RADCO region.

Likelihood of Future Occurrences

West Nile Virus - The sixth annual West Nile Virus conference was held in San Jose, California in February 2005. Although future predictions of WNV could not be defined, the following conclusions from 2004 were drawn at the conference:

- Widespread West Nile virus activity exists over most of the continental United States;
- At least 294 species of birds have been infected. Corvids are the most commonly reported bird to test positive for WNV;
- At least 59 species of mosquitoes have been infected. *Culex* mosquitoes are the most commonly reported mosquito to test positive for WNV;
- WNV-positive bird collections and WNV-positive mosquito collections precede the onset of human cases in most counties;
- The transmission season runs from April to November;
- Neuroinvasive disease and high mortality are the most common among people over 60 years of age; There is an impressive westward movement of most intense WNV transmission;
- No currently approved and effective vaccine and no currently approved and effective antivirals exist; and
- Mosquito control reduces the WNV risk of human infection.

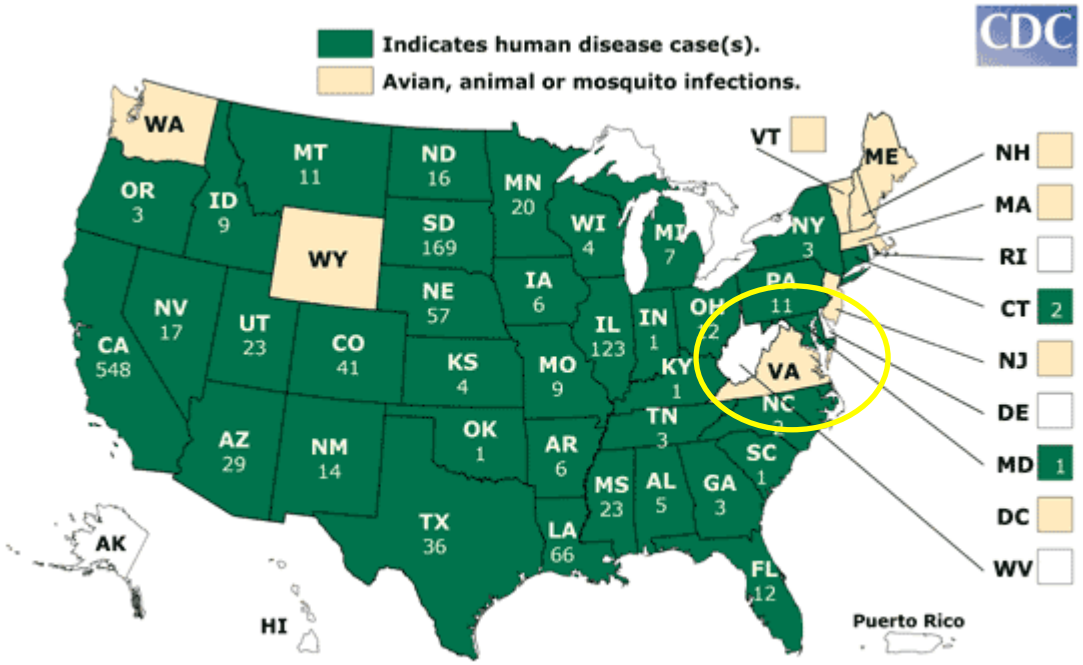


Figure 4.1.1 2005 West Nile Activity in the United States
(Courtesy of the Centers for Disease Control and Prevention, As of September 13, 2005)

Lyme Disease - Although the Center for Disease Control (CDC) currently considers the RADCO region a low risk area for Lyme disease, there are portions of the region that have been a concern in the past. Between 1989 and 1993, the U.S. Army concluded that Fort A.P. Hill was a high-risk area for Lyme disease; in 1991 Quantico Marine Corps base was a high-risk area; and in 1991 the Naval District Washington West - Dahlgren facility was listed as a moderate risk area.

Pandemic Influenza (including Avian Influenza) - According to the CDC, many scientists believe it is only a matter of time until the next influenza pandemic occurs. Although the severity of the next pandemic cannot be predicted, modeling studies suggest that the impact of a pandemic on the United States could be substantial. In preparation, the CDC and the World Health Organization (WHO) have large surveillance programs to monitor and detect influenza activity around the world, including the emergence of possible pandemic strains of influenza virus.

Table 4.1.1
Selected Reportable Diseases in Rappahannock Area Health District 1994-2003

Disease	1994		1995		1996		1997		1998		1999		2000		2001		2002±		2003±	
Population Estimates	184,664		194,165		202,499		203,217		207,736		212,269		241,044		257,186**		257,186**		267,748**	
	(n)	rate¶	(n)	rate¶	(n)	rate¶	(n)	rate¶	(n)	rate¶	(n)	rate¶	(n)	rate¶	(n)	rate¶	(n)	rate¶	(n)	rate¶
Giardiasis	11	5.96	8	4.12	12	5.93	13	6.4	26	12.52	19	8.95	12	4.98	11	4.28	18	6.99	24	8.94
Lead-Elevated Blood Levels†	*	*	*	*	9	18.55	9	18.8	4	8.18	12	24.05	8	22.02	8	13.6	14	5.44	19	7.09
Legionellosis	2	1.08	4	2.06	1	0.49	2	0.98	1	0.48	2	0.94	1	0.41	2	0.78	6	2.33	7	2.61
Lyme Disease	1	0.54	0	0	2	0.99	2	0.98	6	2.89	7	3.3	5	2.07	5	1.94	26	10.11	20	7.47
Rabies, Animal	10	2.34	11	2.4	24	3.92	31	4.49	46	8.38	33	5.68	24	4.18	21	8.52	38	14.78	24	8.96
Rocky Mountain Spotted Fever (RMSF)	1	0.54	8	4.12	7	3.46	1	0.49	3	1.44	5	2.36	0	0	0	0	5	1.94	8	2.98
West Nile Virus	0		0		0		0		0		0		0		0		0		0	

(n) = number of reported cases
¶ Rate per 100,000 population. Population was based on estimates from US Census.
± Data for 2002 and 2003 are provisional.
† Elevated blood lead levels defined as venus blood sample >= 15 micrograms/deciliter.
* Numbers not available.
** Population estimates from Health Department differ from estimates provided by the Weldon Cooper Center for Public Service at the University of Virginia. The Cooper Center estimated the following: 2001 = 254,600, 2002 = 267,400, 2003 = 280,100.
Note: The Rappahannock Area Health District covers the same jurisdictions as RADCO.

Source: Rappahannock Area Health District

4.1.2 Dam Failure

For the purposes of this plan, dam failure is addressed as a natural hazard because flooding conditions are a consequence. Dam failure can occur if hydrostatic pressure behind the dam exceeds its design capacity or the crest of the dam is overtopped and rushing flood water scours the base of the dam. The Virginia Soil and Water Conservation Board (VS&WCB) established the Virginia Dam Safety Program to provide for safe design, construction, operation and maintenance of dams to protect public safety. Dams that meet specific regulatory criteria in are regulated. The owner of each regulated dam is required to apply to the VS&WCB for an operation and maintenance certificate. The application must include an assessment of the dam by a licensed professional engineer, an operation and maintenance plan, and an emergency action plan. The emergency action plan is filed with the appropriate local emergency official and the Department of Emergency Services.

A dam may be exempt from the regulation if any of the following criteria apply:

- The dam is less than six feet in height;
- The dam has a capacity less than 50 acre-feet and is less than 25 feet in height;
- The dam has a capacity of less than 15 acre-feet and is more than 25 feet in height;
- The dam is used primarily for agricultural purposes and has a capacity less than 100 acre-feet (if use or ownership changes, the dam may be subject to regulation);
- The dam is owned or licensed by the Federal Government; or
- The dam is operated for mining purposes under 45.1-222 or 45.1-225.1 of the *Code of Virginia*.

Regulated dams are assigned a hazard classification based on the downstream loss anticipated in the event of dam failure. It should be noted that hazard potential is not related to the structural integrity of the dam. The hazard potential classification speaks to the level of risk to life and economic loss the dam imposes on downstream properties and facilities. The classification scheme used by the VS&WCB is listed below.

- **Class I** - dams which upon failure would cause probable loss of life or excessive economic loss
- **Class II** - dams which upon failure could cause possible loss of life or appreciable economic loss
- **Class III** - dams which upon failure would not likely lead to loss of life or significant economic loss
- **Class IV** - dams which upon failure would not likely lead to loss of life or economic loss to others

Table 4.1.2a provides the number of dams in classes I through III in each community within the RADCO region. The information contained in the table was provided by each county's Emergency Operations Plans (EOPs). Class IV dams do not require an emergency action plan and have, therefore, not been included in the table. For further community-specific information on dams, please contact the office of the local emergency management coordinator.

Table 4.1.2a
Dams in the RADCO Region

Community	No. Class I Dams	No. Class II Dams	No. Class III Dams
Caroline County*	Not provided	Not provided	Not provided
City of Fredericksburg	0	0	0
King George County	3	None	None
Spotsylvania County	2	5	3
Stafford County	1	3	1

*Caroline County's EOP was considered confidential and therefore not provided to AMEC for review, see Caroline County EMS Department for further details
Source: Information provided in County Emergency Operations Plans (EOPs) and organized by AMEC

An additional source of information is the National Inventory of Dams (NID). With the National Dam Inspection Act (P.L. 92-367) of 1972, Congress authorized the U.S. Army Corps of Engineers (USACE) to inventory dams located in the United States. The current NID is the result of this evolutionary process. The USACE continues to work closely with the Association of State Dam Safety Officials (ASDSO), FEMA, and other state and federal agencies to update and publish the NID. Table 4.1.2b presents the number of dams in each community based upon the NID ranking of downstream hazard potential. Downstream hazard potential is defined as:

- **Low** - Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

- **Significant** - Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

- **High** - Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

Table 4.1.2b
National Inventory of Dams
in the RADCO Region

Community	Downstream Hazard Potential		
	High	Significant	Low
Caroline County	2	10	32
City of Fredericksburg	0	0	0
King George County	1	0	7
Spotsylvania County	3	6	10
Stafford County	2	10	6

Source: National Inventory of Dams (http://crunch.tec.army.mil/nid/webpages/nid.cfm)

Past Occurrences

Although a historical log of dam failures for the Commonwealth of Virginia has not been prepared by the VS&WCB, HMPC representatives have noted dam failures in the RADCO region. In recent history, Grant Lake within the Lake Wilderness subdivision of Spotsylvania County was placed under "alert" condition due to the potential for subsidence/sinkhole.

Likelihood of Future Occurrences

The VS&WCB issues certificates to the owner of each regulated dam for a period of six years. If a dam has some deficiency but does not pose imminent danger, the board may issue a two-year *conditional certificate* during which time the owner is to correct the deficiency. After a dam is certified by the board, periodic inspections by an engineer are required.

4.1.3 Drought

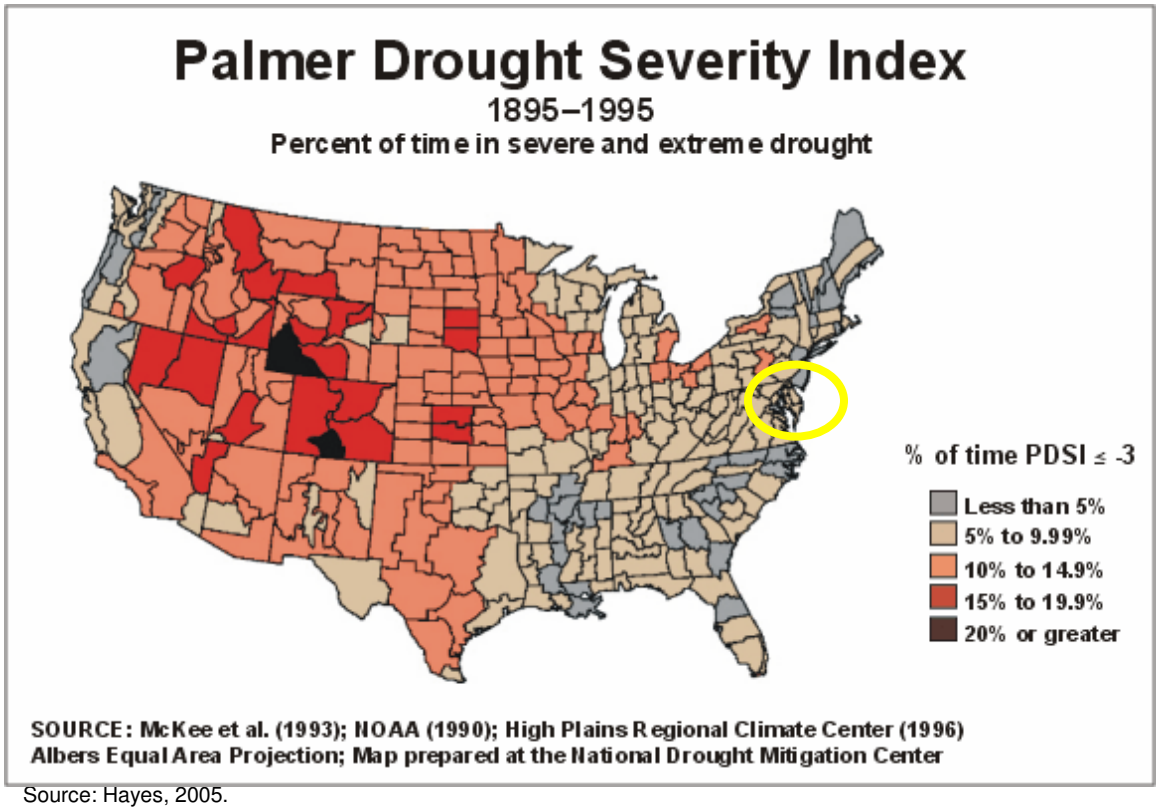
A drought is a period of drier-than-normal conditions that results in water-related problems. All areas of Virginia are susceptible to severe drought, which is defined by a combination of intensity and duration. In a one-year time frame, droughts are considered large when the 12-month rainfall averages approximately 60 percent of normal. On a multi-year time scale, 75 percent of normal rainfall indicates a serious problem. High summer temperatures can exacerbate the severity of a drought. Normal high summer temperatures in the central and northern Virginia areas can reach the 90 degree Fahrenheit mark and higher. Most of the soil is relatively wet, and a great deal of the sun's energy goes toward evaporation of the ground moisture. However, when drought conditions eliminate soil moisture, the sun's energy goes toward heating the ground surface and temperatures reach into the low 100's, further drying the soil. This can have a devastating effect on crops, stream levels and water reserves. A short-term precipitation deficit of six summer weeks can often ruin crops. Droughts lasting a year, which occur in the Mid-Atlantic when the region receives 60 percent of the typical 40 inches of rain, begin to draw down water wells and livestock ponds and decrease stream flows and water reserves.

A common indicator of drought is the Palmer Drought Severity Index (PDSI). The PDSI is a soil moisture algorithm calibrated for relatively uniform regions. It is used by many U.S. government agencies and states to trigger drought relief programs. It was also the first comprehensive drought index developed in the United States. The classifications of the PDSI are presented in Table 4.1.3 (Hayes, 2005).

Table 4.1.3 Palmer Classifications

Palmer Classifications	
4.0 or more	Extremely wet
3.0 to 3.99	Very wet
2.0 to 2.99	Moderately wet
1.0 to 1.99	Slightly wet
0.5 to 0.99	Incipient wet spell
0.49 to -0.49	Near normal
-0.5 to -0.99	Incipient dry spell
-1.0 to -1.99	Mild drought
-2.0 to -2.99	Moderate drought
-3.0 to -3.99	Severe drought
-4.0 or less	Extreme drought

The PDSI indicates that for the period of 1895 through 1995 the RADCO region was in a severe to extreme drought five to 10 percent of the time (Figure 4.1.3a). During periods of drought, the Governor of Virginia has called for a ban of open burning in an effort to reduce the risk of wildfire.



Source: Hayes, 2005.

Figure 4.1.3a Palmer Drought Severity Index

Past Occurrences

There have been five major droughts in Virginia that have affected the communities in the RADCO region since the early 1900's. The drought of 1930-32 was one of the most severe droughts recorded in the state. The droughts of 1938-42 and 1962-71 were less severe; however, the cumulative stream flow deficit for the 1962-71 drought was very damaging due to its long duration. The droughts of 1980-82 and 1998-99 were the least severe for the state; however, the drought of 1998-99 hit the communities of the RADCO region particularly hard.

The drought of 1930-32 had a tremendous impact on Virginia. Numerous rivers completely dried up, crops were totally destroyed, drinking water was difficult to come by, forest fires burned approximately 300,000 acres of land (over 30 times the current annual average) and average summer temperatures were in the low 100's. After adjusting for inflation, the estimated losses for this drought were $1 billion. If the same drought were to occur in Virginia today, the devastation would be much greater due to the increased population and its demand for water resources.

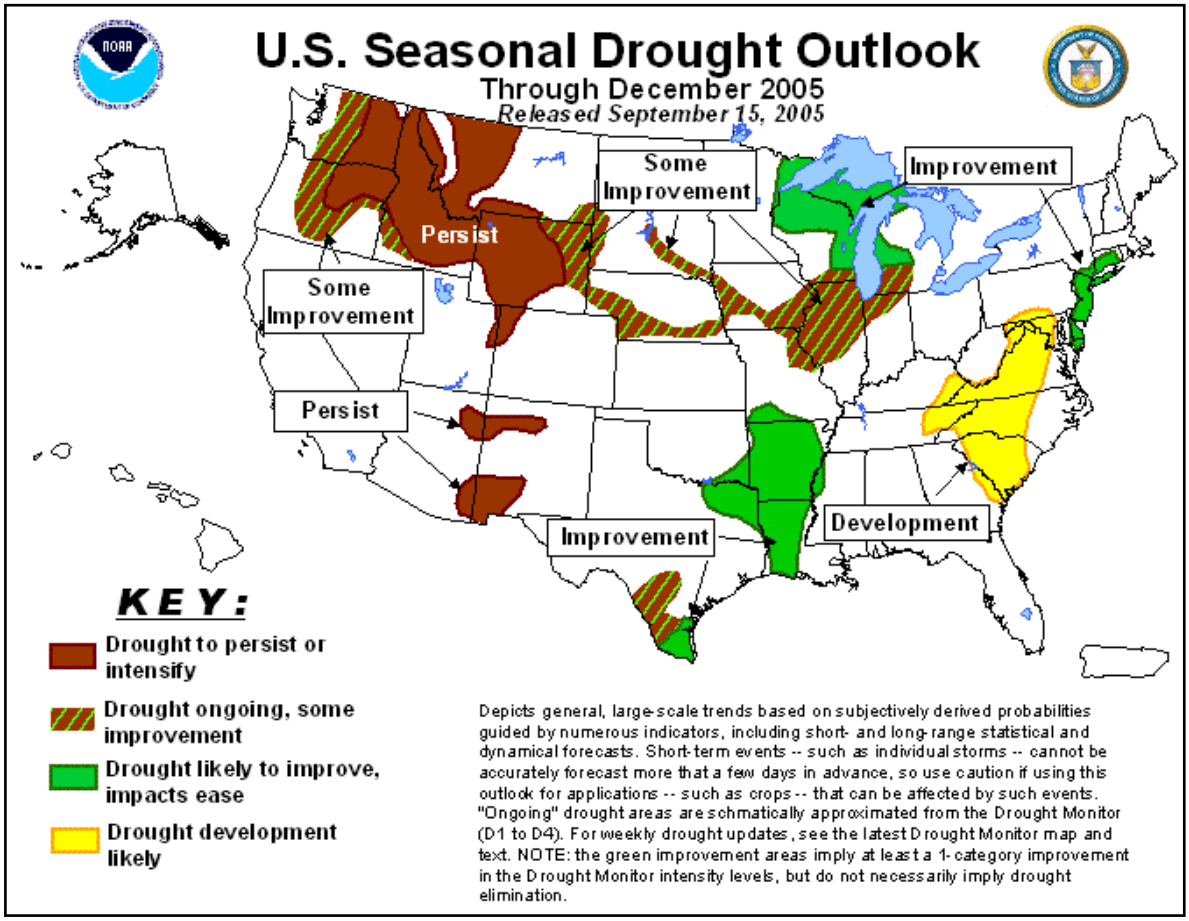
The drought of 1998-99 had a particularly hard impact on the communities of the RADCO region. The region received some of the lowest rainfall totals in over 120 years. This led to the loss of crops, depletion of water and feed reserves and a number of brush fires. Many stream-gauging stations reported stream flow at or below 10 percent of the normal flow. The Rappahannock River at Fredericksburg was at 14 percent of its normal flow, 70 percent of the pasturelands were in poor to very poor condition and many crops in the region were reduced by 30 percent.

On December 1, 1998 the Governor of Virginia declared a state of emergency and called for federal aid. Losses in the Commonwealth grew to nearly $190 million.

Likelihood of Future Occurrences

VDEM rates Virginia's drought risk as "Significant," with Virginia communities experiencing approximately 20 years of severe drought in the last century, which has caused millions of dollars of damage. Proper mitigation planning can lessen a drought's impact and keep communities from being severely impacted by drought conditions.

Additionally, according to the National Weather Service, Climate Prediction Center, drought development in the RADCO region is likely through December 2005 (Figure 4.1.3b).



Source: National Weather Service, 2005.

Figure 4.1.3b U.S. Seasonal Drought Outlook

4.1.4 Earthquakes

An earthquake is a sudden motion or trembling of the earth caused by an abrupt release of stored energy in the rocks beneath the earth's surface. According to the Virginia Department of Mines, Minerals and Energy (DMME), Virginia has a moderate earthquake risk (similar to most states on the eastern seaboard). This risk assessment is further supported by the USGS. The USGS rates areas of the United States for their susceptibility to earthquakes based on a two percent probability of a given peak acceleration (%g) being exceeded in a 50 year period. The RADCO region lies in an area of moderate seismic risk, with a peak acceleration of six to 10 %g, which is considered a moderate hazard probability (See Figure 4.1.4a). Figure 4.1.4a also displays the probability of exceeding a certain ground motion, expressed as peak ground acceleration (PGA). This particular map shows the 10 percent probability of exceeding normal ground motion in 50 years. This translates to a one in 475 chance of normal ground motion being exceeded by the amount shown on the map annually.

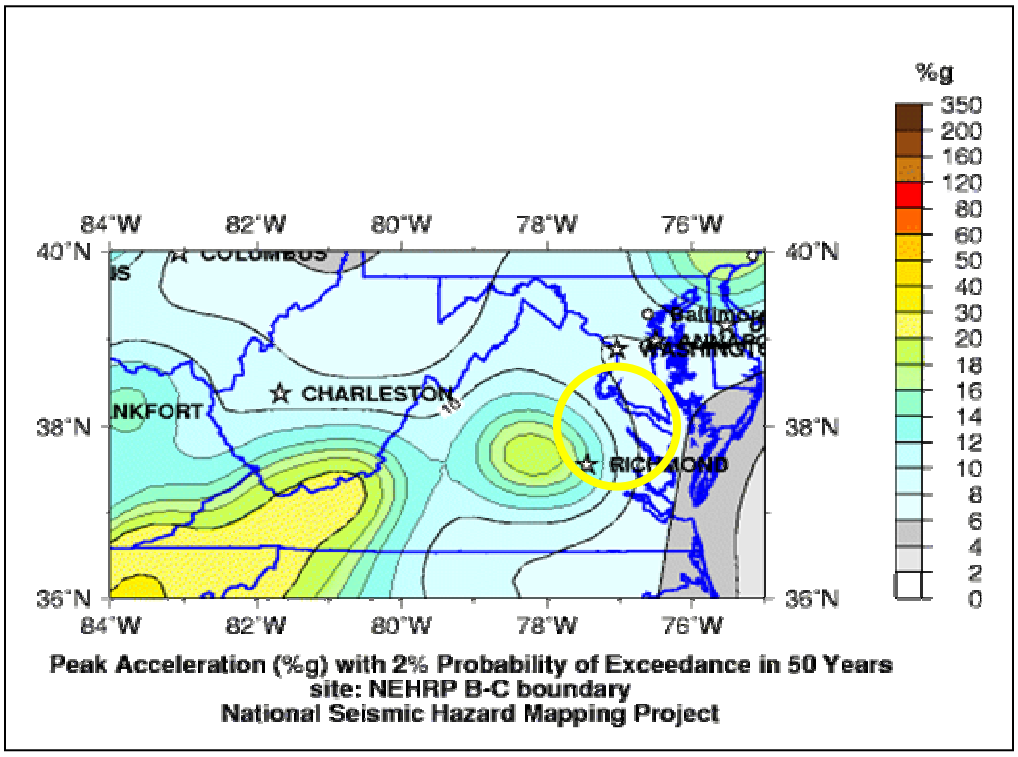
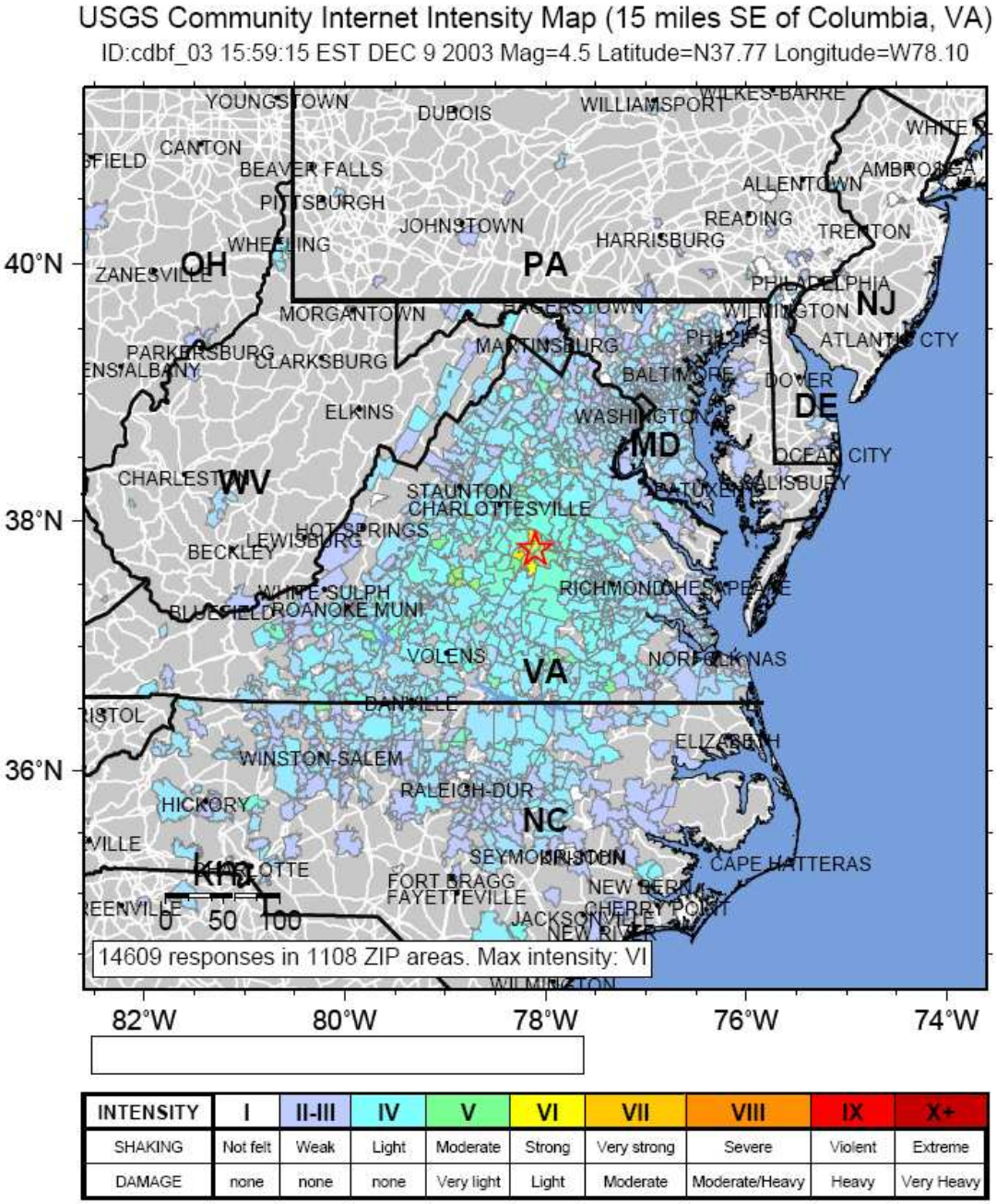


Figure 4.1.4a Peak Acceleration with Two Percent Probability of Exceedance in 50 years

Past Occurrences

The first recorded earthquake in Virginia occurred in 1774. Since then, over 300 earthquakes have been recorded within or near the boundaries of the state. Eighteen of these events had a magnitude of four or higher on the Richter scale. The largest earthquake in Virginia was the 1897 Giles County earthquake. It was felt in over 11 states (approximately 280,000 square miles) and had an estimated magnitude of 5.8, making it the third largest earthquake in the eastern United States. Recently, a 4.5 magnitude earthquake with an epicenter 15 miles southeast of Columbia, Virginia, occurred on December 9, 2003. Effects of the earthquake were reported from over 1,000 zip codes, ranging from weak (II-III intensity) to strong (VI intensity). A map of the responses is shown in Figure 4.1.4b.



INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy

Figure 4.1.4b USGS Community Internet Intensity Map for December 9, 2003 Event
(Source: http://pasadena.wr.usgs.gov/shake/cus/STORE/Xcdbf_03/cdbf_03_ciim.pdf)

Figure 4.1.4c (from the Virginia Division of Mineral Resources, September, 2004) presents the epicenter locations from 2,460 earthquakes in the southeast United States. Map B-1 in Appendix B shows the historic earthquakes that were felt or caused damage to RADCO communities.

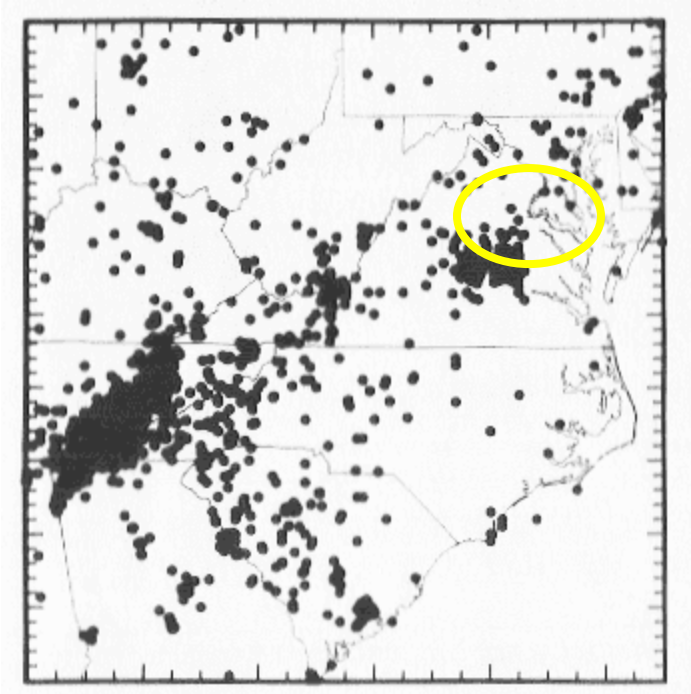


Figure 4.1.4c Epicenter Locations (2460) in the Southeastern United States.

Likelihood of Future Occurrences

According to DMME, Virginia and the RADCO region have a moderate earthquake risk. Although there have been a large number of earthquakes in Virginia since 1774, most have been very small in magnitude and rarely caused damage. Virginia has experienced quakes of a larger magnitude in the past, and will likely experience more at some point in the future. However, compared to the frequency of other hazards such as hurricanes and floods, the frequency with which larger, damaging earthquakes occur in Virginia is considerably lower.

4.1.5 Expansive Soils

Soils with a high enough content of certain types of clay experience a change in volume from dry to wet conditions. These types of soils are called expansive soils or “shrink-swell” soils. Hazards associated with expansive soils arise from the change in volume experienced. This physical factor can result in slope instability and cause damage to building foundations. Each community within the RADCO region addresses the issue of expansive clay in its respective comprehensive plan, and each addresses soil conservation based on state standards set forth in the Virginia Erosion and Sediment Control Law and Regulations.

4.1.6 Extreme Heat

The extreme heat hazard, often referred to as the silent killer, results from high daily temperatures combined with high relative humidity. High relative humidity retards evaporation, robbing the body of its ability to cool itself. On average, approximately 175 Americans die as a result of extreme heat exposure every year (NOAA 2004).

When heat gain exceeds the level the body can remove, body temperature begins to rise, and heat related illnesses and disorders may develop. The Heat Index (HI) is the temperature the body feels when heat and humidity are combined. Table 4.1.6 presents the HI that corresponds to the actual air temperature and relative humidity. This chart is based upon shady, light wind conditions. Exposure to direct sunlight can increase the HI by up to 15°F. (NOAA 2004).

Table 4.1.6
Temperature (F) versus Relative Humidity (%)

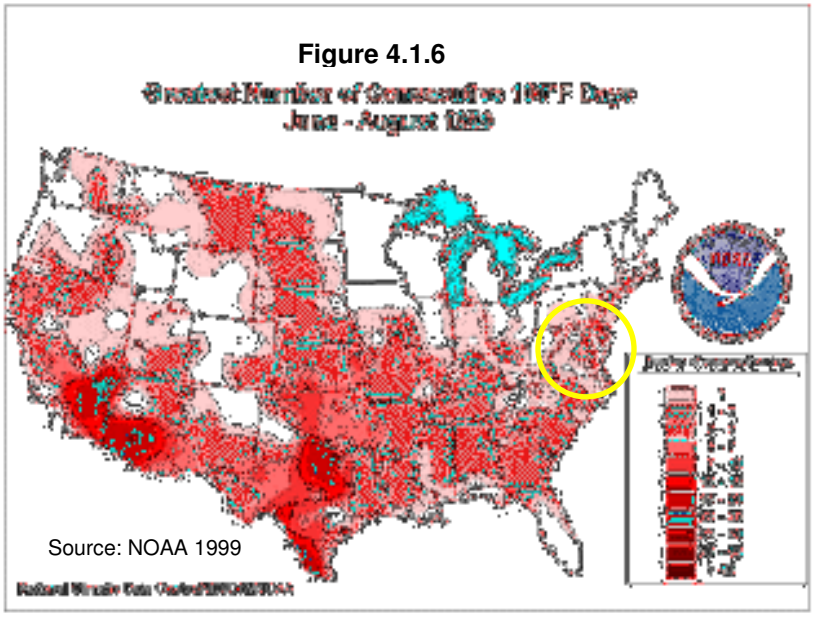
°F	90%	80%	70%	60%	50%	40%
80	85	84	82	81	80	79
85	101	96	92	90	86	84
90	121	113	105	99	94	90
95		133	122	113	105	98
100			142	129	118	109
105				148	133	121
110						135

Source: NOAA 2004: http://www.crh.noaa.gov/pub/heat.htm

Past Occurrences

During the summer (June-August) of 1999, the United States experienced an intensive drought and heat wave. The east coast was the area hardest hit by the drought, with record and near-record short-term precipitation deficits occurring on a local and regional scale resulting in agricultural losses and drought emergencies being declared in several states (NOAA 1999). Figure 4.1.6 shows the number of consecutive days of 100° temperatures, during this time period. The RADCO area experienced between three to five consecutive days in July and August of 1999.

Figure 4.1.6



Likelihood of Future Occurrences

The threat of extreme heat to the RADCO communities is episodic and, although it cannot be controlled, threats to population can be minimized by warnings and public awareness of the potential dangers that extreme heat presents.

4.1.7 Flooding

Flooding is the most frequent and costly natural hazard in the United States. Nearly 90 percent of presidential disaster declarations result from natural events in which flooding is a major component. Excess water from snowmelt, rainfall, or storm surge accumulates and overflows onto adjacent floodplains, the lowlands adjacent to rivers, lakes, and oceans that are subject to recurring floods. While many floodplain boundaries are mapped by FEMA's National Flood Insurance Program (NFIP), floods sometimes go beyond the mapped floodplains or change courses due to natural processes (e.g., erosion, sedimentation, etc.) or human development (e.g., filling in floodplain or floodway areas, increased imperviousness within the watershed from new development, or debris blockage including cars, trailers, and propane tanks). Since the floodplains in the United States are home to over nine million households, most property damage results from inundation by sediment and debris-filled water.

There are four basic types of floods that afflict Virginia's communities, depending on the region of the state examined: coastal flooding (tidal and storm surge), urban flooding, flash flooding, and riverine flooding. The RADCO region is most susceptible to urban flooding and flash flooding. Low-lying areas adjacent to rivers, streams, and creeks are susceptible to riverine flooding. In addition, portions of the Potomac and Rappahannock Rivers in the region are subject to tidal flooding. Urban flooding often occurs in highly impervious (pavement/rooftops/concrete) areas. Impervious surfaces do not allow water to be absorbed into the ground and increase the speed and amount of water that "runs off" property. When areas are without proper drainage, or storm drains become clogged, streets become streams and water gathers in low-lying areas. With enough rain, underpasses can rapidly fill trapping motorists and streets can accumulate enough water to submerge cars or carry them wherever the water flows.

Flash floods occur in a short period of time – in a "flash". Rain falls at such a high rate that water does not have time to be absorbed into the ground. It flows downhill into ditches, lowlands and small streams. As the heavy rain continues, ditches overflow, drains back up, water ponds in lowlands and streams rise over their banks. Streams and creeks can become raging rivers in just minutes. Motorists are often surprised by flash floods, and unfortunately often become victims of the flash flood. More than half of flash flood deaths in the United States occur in automobiles.

Riverine floods occur when heavy rains fall over a large area. In many cases in Virginia, it begins as widespread flash flooding of small streams. Approximately 60 percent of Virginia's river floods begin with flash flooding from tropical systems passing over or near the state. Riverine flooding also occurs because of successive rainstorms. Rainfall from any one storm may not be enough to cause a problem, but with each successive storm's passage over the basin, rivers rise until eventually they overflow their banks. If it is late winter or spring, melting snow in the mountains can produce added runoff that can compound flood problems.

Embrey Dam
The Embrey Dam was constructed in 1910 along the Rappahannock in order to provide hydroelectricity to the Fredericksburg region, which it did for over 50 years. As the population of the area grew and the needs of the communities changed, the Embrey Dam was no longer needed. In an effort to reopen this water to migrating fish species, the decision was made to remove the dam. On February 23, 2004 a 100-foot section of the dam was blown open releasing its impounded water. The United States Army Corps of Engineers estimates that the dam will be completely removed by 2006. The removal of the dam is not anticipated to alter the 100-year floodplain (Reinhart 2004).

Past Occurrences

Flooding of vacant land or land that does not have a direct effect on people or the economy is generally not considered a problem. Flood problems arise when floodwaters cover developed areas, locations of economic importance, infrastructure, and any other critical facility. There have been over 20 significant flash floods in the RADCO area between 1996 and 2003, which demonstrates the RADCO area's susceptibility to future flooding events. The flash flooding and urban flooding that occurs is often brought on by powerful thunderstorms that can dump one to four inches of rain in a matter of a few hours. Small creeks and streams as well as overtaxed drainage systems often cannot cope with the quick influx of rain waters. Their banks can quickly overtop resulting in dozens of flooded roads as well as personal and private property damage.

The Rappahannock River has had four major floods since the early-1970's. These floods exceeded the flood stage by two to 21 feet. The "flood stage" refers to the height of the river or stream at which flooding and property damage begins. Once the water rises above flood stage, damage is expected.

Under the right conditions, flood events can be exceptionally damaging. One such event occurred on February 22, 2003. Powerful rains coupled with a large amount of snowmelt produced flash flooding over the Spotsylvania, Fredericksburg and Stafford areas. The rain washed out dozens of roads and caused the closure of others because of standing water. There were also several reports of uprooted trees as well as personal and private property damage.

See Sections 4.2.1 through 4.2.5 for historical flooding data for each RADCO community.

Likelihood of Future Occurrences

The terms "10-year," "50-year," "100-year," and "500-year" floods are used to describe the estimated probability of a flood event happening in any given year. A 10-year flood has a 10 percent probability of occurring in any given year, a 50-year event has a two percent probability, a 100-year event has a one percent probability, and a 500-year event has a 0.2 percent probability. While unlikely, it is possible to have two 100-or even 500-year floods within years or months of each other.

The potential for flooding can change and increase through various land use changes and changes to the land surface. A change in environment can create localized flooding problems inside and outside of natural floodplains through the alteration or confinement of natural drainage channels. These changes can be created by human activities or by other events, such as wildfires, earthquakes, or landslides.

4.1.8 Hurricanes

Hurricanes and tropical storms, as well as tropical depressions, are all tropical cyclones. According to the National Hurricane Center (NHC), once they have formed, tropical cyclones maintain themselves by extracting heat energy from the ocean at high temperatures and releasing heat at the low temperatures of the upper troposphere. Hurricanes and tropical storms bring heavy rainfall, storm surge, and high wind, all of which can cause significant damage. These storms can last for several days, and therefore have the potential to cause sustained flooding and high wind conditions. Of particular importance to communities susceptible to hurricane damage is the track of an approaching storm. Proximity and direction of hit are important when determining impacts and subsequent damage from the storm.

Hurricane season in the North Atlantic runs from June 1st until November 30th, with the peak season between August 15 and October 15. The average hurricane duration is 12 to 18 hours. Wind speeds may be reduced by 50 percent within 12 hours. These storms are capable of producing a large amount of rain in a short period; as much as six to 12 inches of rain has occurred within a 12 to 16 hour period.

In 1971, wind engineer Herbert Saffir and hurricane expert Dr. Robert Simpson developed a scale to classify hurricanes. The Saffir-Simpson scale rates the intensity of hurricanes based on wind speed and barometric pressure measurements. The National Weather Service uses the scale to predict potential property damage and flooding levels from imminent storms. Although the scale assigns a wind speed and surge level to each category of storm, in recent years, there has been more and more recognition of the fact that wind speed, storm surge and inland rainfall are not necessarily of the same intensity for a given storm. Therefore, there is some interest in classifying hurricanes by separate scales according to each of these risks. However, the Saffir-Simpson Scale is still the most widely used classification tool for hurricanes. The scale is outlined in Table 4.1.8a.

Over time, researchers and meteorologists have further refined the analysis of the wind damage that hurricanes can produce by differentiating the concept of sustained winds from peak gusts. Sustained winds are measured over longer periods of time, typically a minute. A peak gust is the highest two to five second wind speed.

Past Occurrences

Historically, hurricanes have come close enough to Virginia to produce hurricane force winds (>74 mph) approximately three times every twenty years. Recently, the RADCO region's communities were damaged by Hurricane Floyd in September of 1999 and Hurricane Isabel in September of 2003. Hurricane Floyd moved through the area dropping four to five inches of rain within 24 hours and generated winds in excess of 40 mph. Trees and power lines were knocked down, roads flooded, over 5,500 homes were left without power. Hurricane Isabel was much more destructive. Its impact on the Commonwealth of Virginia was staggering; resulting in $1.6 billion in damages with over 1,186 homes and 77 businesses completely destroyed, 9,110 homes and 333 businesses with major damage and over 107,000 homes and 1,000 businesses with minor damage. Hundreds of power lines were blown down leaving almost two million electrical customers without power. Crop losses were calculated to be $59.3 million, with another $57.6 million in damages to farming infrastructure.

Table 4.1.8a
Saffir-Simpson Scale and Typical Damages

Category	Sustained Wind Speeds (mph)	Tidal Surge (ft)	Pressure (mb)	Typical Damage
Tropical Depression	<39	--	--	
Tropical Storm	39-73	--	--	
Hurricane 1	74-95	4-5	> 980	*Minimal* – Damage is done to shrubbery and trees, unanchored manufactured homes are damaged, some signs are damaged, no real damage is done to structures on permanent foundations.
Hurricane 2	96-110	6-8	965-980	*Moderate* – Some trees are toppled, some roof coverings are damaged, major damage is done to manufactured homes.
Hurricane 3	111-130	9-12	945-965	*Extensive Damage* – Large trees are toppled, some structural damage is done to roofs, manufactured homes are destroyed, and structural damage is done to small homes and utility buildings.
Hurricane 4	131-155	13-18	920-945	*Extreme Damage* – Extensive damage to roofs, windows, and doors, roof systems on small buildings completely fail, some curtain walls fail.
Hurricane 5	> 155	> 18	< 920	*Catastrophic Damage* – Roof damage is considerable and widespread, window and door damage is severe, there are extensive glass failures, some buildings fail completely.

Source: National Weather Service, National Hurricane Center, 2005.

In evaluating the localized threat of hurricanes and tropical storms to the region, the HMPC analyzed hurricane track data from the National Oceanic and Atmospheric Association (NOAA) from 1851 to 2003 to identify storms that have posed a threat to the area (Table 4.1.8b). Based on this data, 20 storms, including hurricanes, tropical storms, tropical depressions, and extratropical storms tracked through the RADCO region during that time period (Map B-2, in Appendix B). Of the 20 storms, nine were tropical depressions and extratropical storms (winds <39 mph), and seven were tropical storms (winds of 39-73 mph). In addition, the 2004 hurricane season was one of the most severe in recorded history. Five separate tropical cyclones (Charley, Frances, Ivan, Jeanne, and Gaston) of varying magnitude hit the eastern and Gulf coasts of the United States. It should be noted that the RADCO communities are affected by storms that do not track across its borders. High winds and large rain events associated with passing storms have caused localized damage in the past. Examples include Hurricane Agnes in 1972 and Hurricane Bertha in 1996.

See Sections 4.2.1 through 4.2.5 for historical hurricane data for each RADCO community.

Likelihood of Future Occurrences

VDEM rates Virginia's overall wind risk as "High," and the RADCO communities are no exception. Historical occurrences of high winds generated by hurricanes and tropical storms are a strong indication of future events. With proper planning, the impact and amount of damage caused by high winds can be lessened.

Table 4.1.8b
Historic Hurricanes that Tracked Across RADCO Communities 1851 to 2004

Year	Name	Pressure (mb)	Wind (mph)	Category*
1876	Not Named	985	80	H1
1876	Not Named	987	70	TS
1878	Not Named	0	105	H2
1883	Not Named	0	45	TS
1883	Not Named	0	35	TD
1886	Not Named	0	35	TD
1899	Not Named	0	65	TS
1915	Not Named	0	35	TD
1928	Not Named	0	45	TS
1928	Not Named	1002	45	TS
1929	Not Named	0	40	E
1939	Not Named	0	30	TD
1944	Not Named	0	50	TS
1945	Not Named	1012	40	TS
1954	Hazel	970	90	E
1955	Connie	NA	NA	H1
1960	Donna	NA	NA	H2
1960	Camille	NA	NA	TD
1979	Bob	1010	25	TD
1981	Bret	1006	35	TD
1999	Floyd	NA	NA	H1
2003	Isabel	NA	NA	H2
2004	Charley And Bonnie	NA	NA	H1
2004	Frances	NA	NA	H1
2004	Ivan	NA	NA	H1
2004	Jeanne	NA	NA	H1
2004	Gaston	NA	NA	TD

Source: NOAA National Hurricane Center, 2004 data

* Category Hurricanes include: H2 = Category 2 (96 – 100 mph)
H1 = Category 1 (74 – 95 mph)
TS = Tropical Storm (39 – 73 mph)
TD = Tropical Depression (17 – 38 mph)
E = Extratropical Storm
NA – Data not available

4.1.9 Landslide

Landslides constitute a major geologic hazard because they are widespread, occurring in all 50 states, and cause $1 to 2 billion in damages annually and more than 25 fatalities on average each year (USGS 2003). Losses involve federal, state and private lands. Landslides can and do occur in conjunction with other natural hazards, such as heavy rain events and earthquakes or human activities like excavations. Landslides can be broken down into falls, flows, or slides based on the type of earth movement.

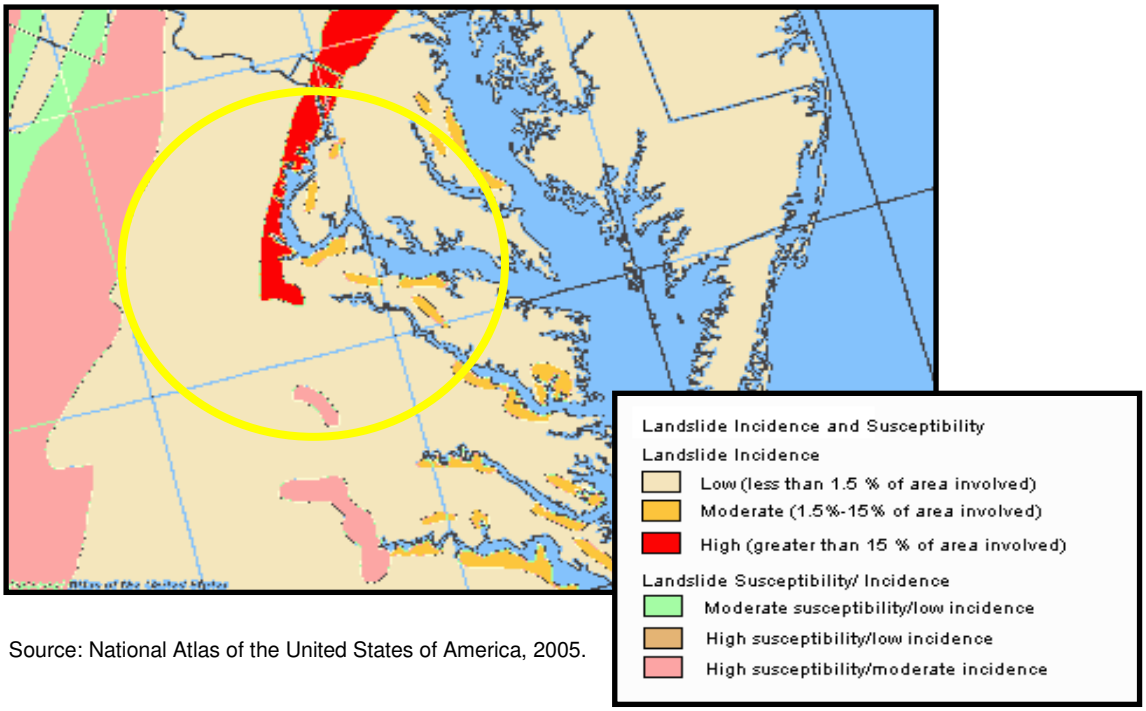
Past Occurrences

Historic landslide events, as presented by DMME, have been predominately associated with heavy rainfall events along the steep slopes of the Blue Ridge Mountains.

Likelihood of Future Occurrences

Most of the RADCO region is classified as low landslide risk on the Landslide Incidence and Susceptibility Map (USGS 2001), with a few exceptions. There is a small area in southern Caroline County that is identified Combo-high (high susceptibility to land sliding and moderate incidence). An area designated as High is located in southeastern Stafford County, northeastern Spotsylvania County, northern Caroline County, a small portion of the City of Fredericksburg and a tiny piece of King George County. King George also has two areas identified as moderate risk areas (see Landslide Map B-3 for RADCO area). The data used to generate these maps (USGS 2001) is highly generalized, owing to the small scale and the scarcity of precise landslide information for much of the region. The data, according to the USGS, is not suitable for local planning or site selection. The HMPC has utilized this information to acknowledge landslides as a potential hazard. Members of the HMPC considered the hazard to be non-critical with a low probability of occurrence as few historic events were recalled. Additional data regarding incidences of landslides is not available at this time. Further investigation at the local level is required for more detailed information.

Figure 4.1.9 Landslide Incidence and Susceptibility



Source: National Atlas of the United States of America, 2005.

4.1.10 Northeasters

Northeasters are slow moving, low-pressure systems that typically form either in the Gulf of Mexico or in the Atlantic Ocean. Although typically associated with winter storm events, Northeasters can occur during anytime of the year. Low-pressure systems develop into storms that bring strong northeast winds, heavy rains/precipitation and storm surge to coastal areas. The winds and storm surge resulting from northeasters are generally less intense than that of hurricanes. However, unlike hurricanes, these storms can linger for several days over a given area allowing larger accumulations of precipitation as well as more damage to structures, since they are exposed to wind and flooding for longer periods of time.

The Dolan-Davis Scale (1993), as presented in Table 4.1.10a, was developed to identify and classify the damages that may occur during these storm events. This scale is a useful tool for estimating the damage potential of a northeaster. This scale is especially useful to those communities in the RADCO region that experience tidal flooding.

Table 4.1.10a
Dolan-Davis Northeaster Intensity Scale (Davis and Dolan, 1993)

Storm Class	Beach Erosion	Dune Erosion	Overwash	Property Damage
1 (Weak)	Minor changes	None	No	No
2 (Moderate)	Modest; mostly to lower beach	Minor	No	Modest
3 (Significant)	Erosion extends across beach	Can be significant	No	Loss of many structures at local level
4 (Severe)	Severe beach erosion and recession	Severe dune erosion or destruction	On low beaches	Loss of structures at community-scale
5 (Extreme)	Extreme beach erosion	Dunes destroyed over extensive areas	Massive in sheets and channels	Extensive at regional-scale; millions of dollars

Source: North Carolina Division of Emergency Management, http://www.dem.dcc.state.nc.us/mitigation/noreaster.htm

Past Occurrences

Table 4.1.10b is a listing of historic northeasters for the RADCO region.

Table 4.1.10b
Historic Northeasters – RADCO Region

Date	Description
January 28, 1772	This storm was named the "Washington and Jefferson Snow Storm" since it was recorded in both of their diaries. The storm left near 30 to 36 inches (3 feet) of snow from Charlottesville to Winchester to Washington. It was the greatest snow anyone could remember at that time and remains the unofficial record to present day (official records begin in 1872). People were unable to travel for up to two weeks due to the deep snow pack. It took 5 weeks for postal service to resume.
"The Hard Winter of 1779-1780"	This winter was so cold that ice was said to have been piled 20 feet high along the Virginia Coast and stayed there until spring. The upper portion of the Chesapeake Bay was frozen allowing people to walk from Annapolis to Kent Island, Maryland. The Virginia portion of the Bay was frozen to near the mouth. All waterways (rivers) in Virginia were reported firm enough to support crossing of soldiers and in some cases, loaded wagons. America was in its War of Independence. In March, a regiment of the Virginia Infantry marched from Falmouth to Fredericksburg. They were able to cross the Rappahannock River, which had been frozen since the previous November.
January 6-7, 1821	A Northeaster of great intensity hit the Eastern Seaboard from Charleston, SC to New England. The band of deep snow stretched from the Virginia interior to the New Jersey Coast. Winchester had 8 inches of snow. Washington DC had between 12 and 18 inches. Temperatures fell to below zero in some areas behind the storm.
January 21, 1863	A severe coastal storm dropped heavy rains on the Fredericksburg area. It rained for 30 hours dropping upwards of two inches. The subsequent mud was so deep that mules and horses died in the attempt to move equipment. The rivers became too high and swift to cross. It disrupted the Union Army offensive operation in the ill-famed "Mud March".
January 13-14, 1912	An arctic cold wave struck the region with subzero temperatures. Washington DC fell to -13°F, Quantico fell to -16°F, Fredericksburg -11°F, Culpeper -20°F, Lincoln (Loudoun County) -25°F, Woodstock -22°F, Harrisonburg -25°F , Staunton -12°F and Lexington -16°. In Rockingham County and Loudoun County these were the coldest temperatures ever recorded beating the arctic blast in February 1899.
February 15-16 and March 20-21, 1958	Over 14 inches of snow fell in Northern Virginia in the Washington area in a mid-February storm. Transportation was paralyzed. Two deaths in Virginia were attributed to the storm. Another Northeaster struck on March 21, dropping another 10 to 15 inches in the central mountains and across northern Virginia.
February 10-11, 1983	Known as the "Blizzard of '83", this storm event covered an unusually large area of Virginia with more than a foot of snow. The storm set a new 24-hour snowfall record in Lynchburg with 14.6 inches, Roanoke with 18.6 inches and Richmond with 16.8 inches. Richmond received 18 inches total and parts of Northern Virginia measured as much as 30 inches on the ground. Winds gusted over 25 mph all day on February 11 in the Richmond area causing three-foot high drifts. This was the third heaviest snowfall on record for Richmond for the last 100 years. The cost of clearing the snow from state roads came to $9 million.

Table 4.1.10b
Historic Northeasters – RADCO Region

Date	Description
February 2-3 and February 16, 1996, Storms	A continuing series of Alberta clippers followed by strong Northeasters struck the Commonwealth. The storm on February 2-3, dropped one to two feet of snow from Charlottesville to Fredericksburg and across the Northern Neck. 6 to 10 inches of snow fell to the north of the heavy snow band and significant icing occurred to the south of the band. Some counties along the North Carolina border saw approximately half of its population lose power. The ice caused approximately a half million dollars in damage and caused widespread disruptions in the Hampton Roads area. Following the fresh snow and ice came a cold wave from the 3rd through the 6th with many areas dropping below zero. On the 5th, several places set new records. Lynchburg set a new all-time record low temperature reaching -10° F and Burkes Garden recorded -22° F, which is one of the coldest temperatures ever recorded in Virginia. On the 16th, another Northeaster moved up the coast dumping 6 to 12 inches of snow in a swath across Virginia from Nottoway to Fredericksburg with Charlottesville on the west side of the heavy band and Richmond on the east side.
Winter of 1995-1996	Much of Virginia, mainly north and west of Richmond, had either a record seasonal snow total or a top three snowfall for the 20th century. Lynchburg set a new record with 57 inches of snow and Dulles with 62 inches. Blacksburg had 76 inches. Bluemont recorded 87 inches. Fredericksburg and the Northern Neck saw nearly 60 inches of snow. Roanoke recorded its third snowiest season with 53.4 inches.
January 24-25, 2000	The Northeaster spread heavy snow into Virginia during the night of the 24th and through the 25th. Storm warnings were posted for the late news on the 24th, but those who went to bed early without catching the news were startled to see the heavy white stuff falling in the morning. Several inches of snow was on the ground at daybreak, with winds gusting at 25 to 45 mph creating blizzard conditions in some areas. The region was at a stand still. Airports and transit systems were shut down. Schools were closed. Federal, state and county government offices were closed or quickly closed once the full impact of the storm was realized. Some federal employees in Northern Virginia who begin their commutes well before the government shutdown at 7 am were left battling the storm to attempt to return home. Drifts of four to five feet were common. Snow mixed with sleet and freezing rain in some of the eastern counties.

Source: VDEM 2004

Likelihood of Future Occurrences

According to the neighboring emergency management agency of North Carolina, the frequency of major northeasters (class four and five on the Dolan-Davis Scale) has increased in recent years. In the period 1987 to 1993, at least one class four or five storm has occurred each year along the Atlantic seaboard of the United States, a situation duplicated only once in the last 50 years.

4.1.11 Thunderstorms

Thunderstorms are defined as localized storms, always accompanied by lightning, and often having strong wind gusts, heavy rain and sometimes hail or tornadoes. Thunderstorms can produce a strong out-rush of wind known as a downburst, or straight-line winds which may exceed 120 mph. These storms can overturn mobile homes, tear roofs off of houses and topple trees.

Approximately 10 percent of the thunderstorms that occur each year in the United States are classified as severe. A thunderstorm is classified as severe when it contains one or more of the following phenomena:

- Hail measuring ¾ inch or greater;
- Winds gusting in excess of 50 knots (57.5 mph); or
- A tornado.

A *severe thunderstorm watch* is issued by the National Weather Service when the weather conditions are such that a severe thunderstorm is likely to develop. This is the time to locate a safe place in the home and to watch the sky and listen to the radio or television for more information.

A *severe thunderstorm warning* is issued when a severe thunderstorm has been sighted or indicated by weather radar. At this point, the danger is very serious and it is time to go to a safe place, turn on a battery-operated radio or television, and wait for the "all clear" from authorities.

Among the hazards that thunderstorms can bring is ground striking lightning. Lightning can strike up to 10 to 15 miles from the rain portion of the storm. The lightning bolt originates from the upper part of the thunderstorm cloud known as the anvil. A thunderstorm can grow up to eight miles into the atmosphere where the strong winds aloft spread the top of the thunderstorm cloud out into an anvil. The anvil can spread many miles from the rain portion of the storm, but it is still a part of that storm. Lightning from the anvil may strike several miles in advance of the rain. Lightning bolts may also come from the side or back of the storm, striking after the rain and storm may seem to have passed or hitting areas that received little or no rain.

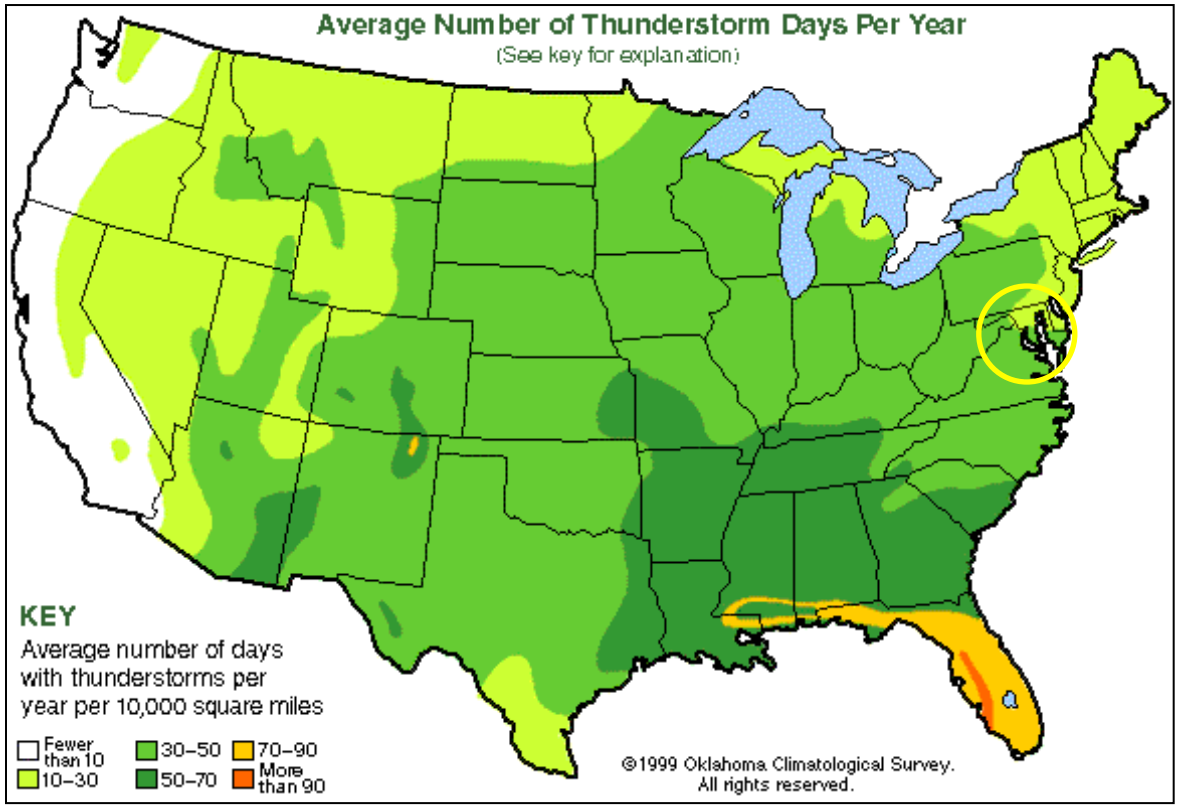
Past Occurrences

There have been seven people injured and well over $100,000 in property damage caused by lightning strikes in the RADCO area between 1993 and 2003. The majority of the damage caused by lightning in the area involved home strikes, small brush fires, power line failures and animal deaths. For example, in June of 1994, lightning killed three cows and downed several trees and power lines in the RADCO area, resulting in over 7,500 residents left without power. A similar instance occurred in August of 1996 where lightning hit multiple power lines, transformers and homes. Minor property damage occurred and 2,100 people were left without power. Like many other natural hazards that can affect a very small area but have a large impact on the area affected, air-to-ground lightning strikes are likely to occur far more frequently than current statistics would indicate.

See Sections 4.2.1 through 4.2.5 for historical thunderstorm data for each RADCO community.

Likelihood of Future Occurrences

Thunderstorms are likely to occur in the RADCO region approximately 30 to 50 days each year (Figure 4.1.11).



Source: Oklahoma Climatological Survey, 2005.

Figure 4.1.11 Average Number of Thunderstorms Days per Year

4.1.12 Tornadoes

Tornadoes are one of nature's most violent storms. In an average year, approximately 1,000 tornadoes are reported across the United States, resulting in 80 deaths and over 1,500 injuries. A tornado is a rotating column of air extending from a thunderstorm to the ground. The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 mph or more. Damage paths can be in excess of one mile wide and 50 miles long. A tornado's destructive power is measured using the Fujita Damage Scale (See Table 4.1.12).

Table 4.1.12
Fujita Damage Scale

Scale	Wind Estimate (MPH)	Typical Damage
F0	< 73	Light Damage, some damage to chimneys; branches off trees; shallow-rooted trees pushed over; sign boards damaged.
F1	73-112	Moderate Damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2	113-157	Considerable Damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
F3	158-206	Severe Damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4	207-260	Devastating Damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.

Source: Fujita 1971, NOAA, http://www.spc.noaa.gov/faq/tornado/f-scale.html

Past Occurrences

A tornado's intense power often destroys homes, downs power lines, and can cause significant tree damage. One such instance occurred on July 24, 1999 in the RADCO area. An F1 tornado moved through 20 miles of the area. It uprooted and snapped hundreds of trees and power lines, did minor damage to several homes, businesses, and farms, and tore the roof off of a local school. Although there were no injuries reported, damages totaled over $1.0 million.

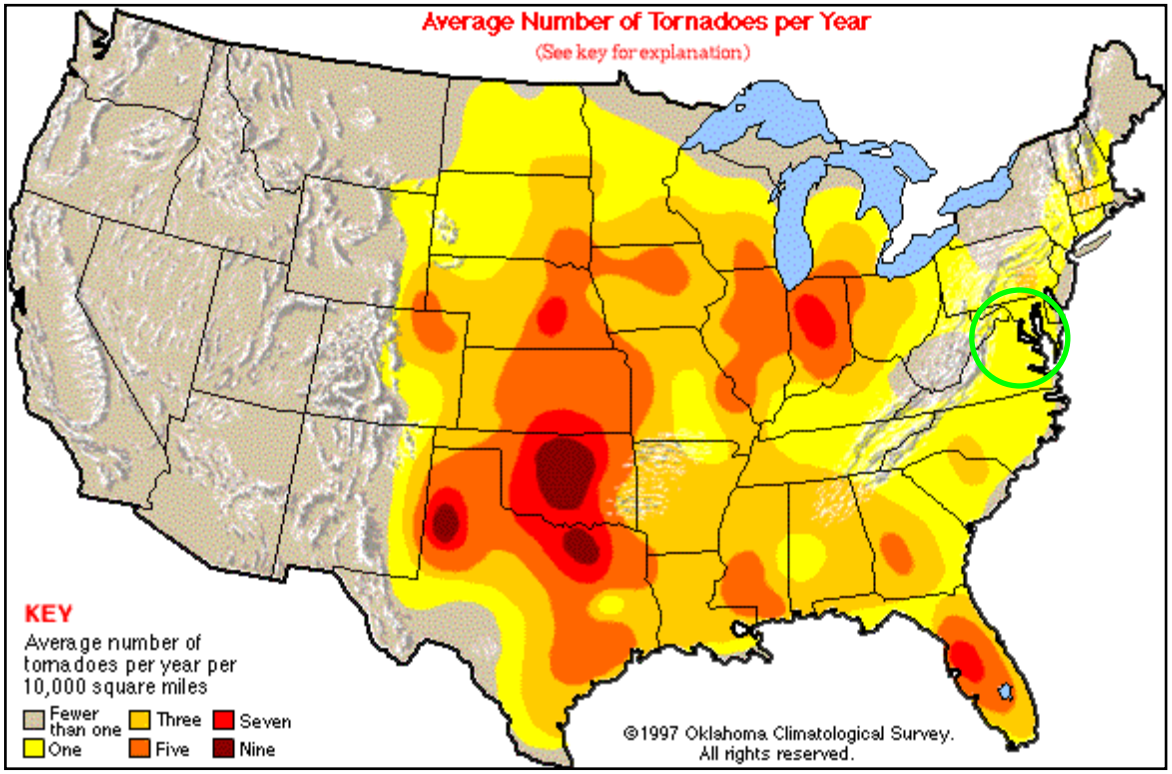
The RADCO area has experienced 17 tornadoes since 1960, with damages totaling nearly $2.0 million. Most of the tornadoes in the area are of a magnitude F0 – F1 (15 since 1960). However, two tornadoes in the area have reached a magnitude of F2 – F3. In Virginia, most tornadoes occur from April to October. However, tornadoes can strike at any time during the year.

Hurricanes Frances and Charley of the 2004 hurricane season spawned numerous tornadoes in the region, three of which were confirmed by the National Weather Service. As detailed information relating to damage and wind speed intensity on the Fujita scale become available over time, the region's communities may wish to update this portion of the plan. As described in the section discussing lightning strikes, it is important to note that tornadoes other than the ones reported here might have occurred in the region over time. However, unconfirmed tornadoes cannot be included in the body of tornado statistics.

See Sections 4.2.1 through 4.2.5 for historical tornado data for each RADCO community.

Likelihood of Future Occurrences

The RADCO region can anticipate one tornado per 10,000 square miles each year (Figure 4.1.12).



Source: Oklahoma Climatological Survey, 2005.

Figure 4.1.12 Average Number of Tornadoes per Year

4.1.13 Wildfire

A wildfire is an uncontrolled fire spreading through vegetative fuels, possibly consuming structures. They often start unnoticed and spread quickly, often causing dense smoke that fills the area for miles around. Naturally occurring and non-native species of grasses, brush, and trees fuel wildfires. (FEMA, How-to Guide, 2-29) Generally, there are three major factors to consider in assessing a community threat from wildfires: topography, vegetation, and weather.

The type of land cover in an area affects a number of factors including ease of ignition, the intensity with which a fire burns, and the facilitation of wildfire advancement. Topographic variations, such as steeper slopes, can lead to a greater chance of wildfire ignition. Generally speaking, steeper slopes are predisposed to convective pre-heating, which warms and dries the vegetative cover. Also, slopes that generally face south receive more direct sunlight than those facing north. Direct sunlight in turn dries vegetative fuels, thereby creating conditions that are more conductive to wildfire ignition. Population density has a causal relationship to wildfires because an overwhelming majority of the wildfires in Virginia are ignited intentionally or unintentionally by humans. Travel corridors increase the probability of human presence, which increases the potential for wildfire ignition. Hence, areas closer to roads have a higher ignition probability. The hurricanes of the past few years, especially Hurricane Isabel, have brought down hundreds of trees. This increase in potential fuel has initiated a public awareness campaign by the Virginia Department of Forestry (VDOF) to educate the public to this increased hazard.

Past Occurrences

There were approximately 520 wildfires in the RADCO area between 1995 and 2001. The wildfires resulted in over 1000 acres burned and $330,000 in damages. Although the majority of these fires were caused by humans, over 70 were determined to be caused by lightning or unknown causes.

See Sections 4.2.1 through 4.2.5 for historical wildfire data for each RADCO community.

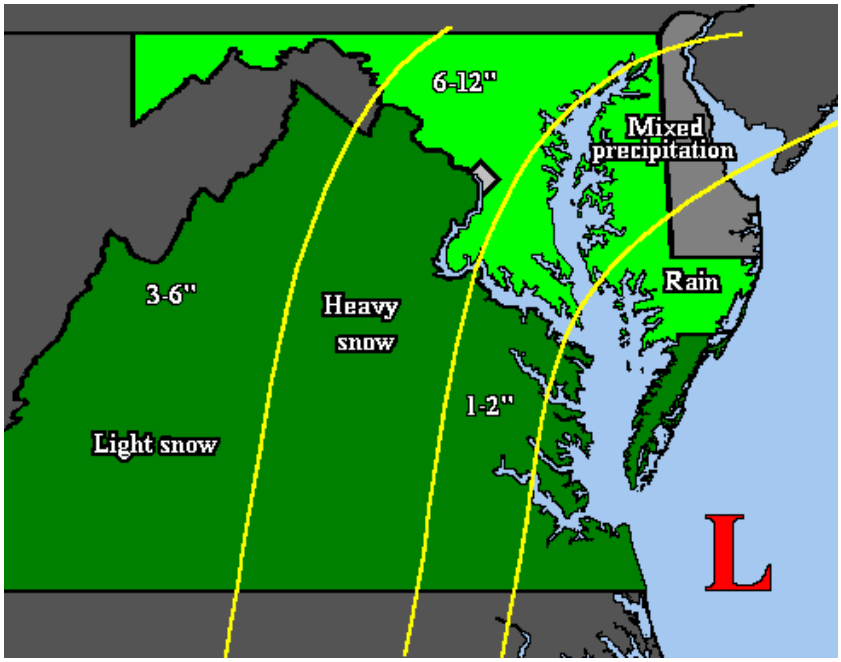
Likelihood of Future Occurrences

Using the factors described above, VDOF assigned a “fire-risk” rating of low, moderate, or high (See Map B-4 in Appendix B) to various areas throughout the RADCO region. With this system, VDOF has determined that approximately 40.5 percent of the RADCO area is in a high fire risk zone, 50.2 percent is in a moderate fire risk zone and 9.3 percent is in a low fire risk zone.

It is apparent that wildfires are a danger within the RADCO area. The area’s specific vegetative cover, topography and urban characteristics (relatively high population and dense road networks in some areas) furnish an environment with a predominantly high fire risk. Historical evidence shows that many historic fires could have been prevented with proper mitigation, lessening the negative impact on the environment and the citizens of the RADCO area.

4.1.14 Winter Storms

Winter storms can combine different types of precipitation including snow, freezing rain, and ice, as well as high winds, and cold temperatures. These storms can be very disruptive, particularly in areas where they do not occur frequently. Strong winds with these intense storms can knock down trees, utility poles, and power lines. Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. These storms can disrupt communications and power for days while utility companies work to repair the potentially extensive damage. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians. Heavy snow can immobilize a region and paralyze a community, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse buildings and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. The cost of snow removal, repairing damages, and loss of business can also have a significant economic impact on communities.



Source: VDEM 2004

Figure 4.1.14 Local Precipitation Map

It is quite common for the rain-snow line to fall right over Petersburg, Richmond, or Fredericksburg. Heavy snow often falls in a narrow 50-mile wide swath approximately 150 miles northwest of the low pressure center (see Figure 4.1.14 - Low pressure center or storm center is represented by an "L"). The RADCO area often finds itself within this 50-mile wide swath of dangerous winter weather.

Past Occurrences

It is also not uncommon for the RADCO area to experience sleet, freezing rain and ice storms. Table 4.1.14 identifies significant winter storm events in the RADCO region.

Table 4.1.14
Significant Winter Storm Events – RADCO Region

Date	Description
January 6-8, 1996	Much of the eastern seaboard received 1 to 3 feet of snow during the "Blizzard of '96." Wind gusts of over 50 mph were common and resulted in blizzard conditions for much of the east coast, including Virginia. Many areas of Virginia received over 20 inches of snow. Numerous accidents and flood related damages were reported in the area, along with 13 deaths in Virginia. Virginia, along with Ohio, Pennsylvania, Maryland, West Virginia and New York were declared Presidential Disaster Areas. All totaled, the blizzard and resulting flooding killed and estimated 187 people and caused approximately $3 billion in damages along the eastern seaboard.
January 25, 2000	A significant winter storm dumped over one foot of snow across much of central and eastern Virginia, with isolated amounts close to two feet. Caroline County reported over 12 inches of accumulation. There was also significant blowing and drifting of snow as winds gusted over 30 mph during the storm. This resulted in very hazardous conditions and snow drifts of 3 to 5 feet.
February 22, 2001	A winter storm dropped 2 to 5 inches of snow in the RADCO area. The amount of snow itself is not as significant as the amount of time in which it dropped. Several areas received a brief period of heavy snow at the beginning of the event, which created whiteout conditions. An interstate pileup of record proportions (131 vehicles) occurred in Stafford County on I-95 around 10:30 AM. Across Virginia, officers responded to 1520 crashes involving a total of 400 vehicles.
January 02, 2002	A winter storm dumped 7 to 8 inches of snow in Caroline County and other areas across central and eastern Virginia. Local law enforcement agencies reported numerous accidents and most schools were closed through January 4th due to slippery road conditions.
February 06, 2003	A winter storm produced 4 to 7 inches of snow across the piedmont of central Virginia and the Virginia Northern Neck. Some of the highest snow amounts in the region occurred in Caroline County. Very slippery road conditions lasted through February 7th, resulting in numerous accidents and school closings.
February 15, 2003	A winter storm produced 4 to 9 inches of snow, along with sleet and freezing rain, across central and eastern Virginia. Caroline County had some of the highest snow amounts with 9 inches of accumulation. Very hazardous road conditions lasted through February 18th. Local law enforcement agencies reported several accidents and schools in the area were closed.

Source: Watson 2004.

Likelihood of Future Occurrences

There were six recorded winter storm events in the RADCO region between 1996 and 2003 (a seven year period), suggesting a near annual recurrence interval.

4.1.15 Multi-Hazard Correlation

While this plan investigates individual hazard history and occurrence, it should be noted that hazards typically occur together or result in other hazards later in time. For example, hurricanes are defined by sustained wind speed but not all hurricane damage is from wind. Heavy rains associated with these storms and storm surge generated by waters piled up on shore result in devastating flooding. The effects of natural hazards can last years after the initial devastating events. High wind events blow down trees, which can increase the wildfire hazard for years to come due to an increase in downed dead or dying woody debris. In addition, uprooted trees in low-lying or typically damp areas can cause other problems. The root bulb from the fallen tree can excavate large holes in the landscape, which when filled with rainwater can provide breeding grounds for mosquitoes.

4.1.16 Critical vs. Non-critical Hazards

Based on readily available data, local knowledge and observations, the HMPC performed a two-stage evaluation of above-mentioned hazards utilizing the Natural Hazard Ranking Sheet (Appendix C). First, they grouped the hazards into two categories; critical and non-critical hazards (Table 4.1.16).

> **Non-critical hazards:** those hazards resulting in slight to negligible property damages (less than 25% of critical and non-critical facilities and infrastructure); moderate to negligible quality of life lost; injuries or illnesses do not result in permanent disability and there are no deaths; and critical facilities are shut down for less than one week.
>
> **Critical hazards:** those hazards resulting in severe to moderate property damages (greater than 25% of critical and non-critical facilities and infrastructure); injuries or illnesses result in permanent disability and at least one death; and critical facilities are shut down for more than 1 week.

Secondly, the HMPC, in conjunction with the consulting team, ranked each critical hazard based on the probability of occurrence (Table 4.1.16). Hazards that ranked critical with a medium to high probability of occurrence were then investigated further and a vulnerability analysis was performed.

4.1.17 Probability of Occurrence

The probability of occurrence of a hazard event provides an estimation of how often the event occurs. This is generally based on the past hazard events that have occurred in the area and the forecast of the event occurring in the future. This is done by assigning a probability factor, which is based on yearly values of occurrence. The numerical value assigned to each category will be used to determine the risk rating of each hazard. These values were assigned by high, medium, and low occurrence:

- High – Frequent events with a well documented history of occurrence. Annual probability greater than 1.
- Medium – Occasional occurrences with at least two or more documented historic events. Annual probability is between 0.1 and 0.99.
- Low – Rare occurrences with at least one documented or anecdotal historic event. Annual probability less than 0.1.

Table 4.1.16
Hazard Identification Results

	Caroline County		Town of Bowling Green		Town of Port Royal		City of Fredericksburg		King George County		Spotsylvania County		Stafford County	
Hazard type	Critical vs. Non-Critical	Probability of Occurrence	Critical vs. Non-Critical	Probability of Occurrence	Critical vs. Non-Critical	Probability of Occurrence	Critical vs. Non-Critical	Probability of Occurrence	Critical vs. Non-Critical	Probability of Occurrence	Critical vs. Non-Critical	Probability of Occurrence	Critical vs. Non-Critical	Probability of Occurrence
Biological Hazards	C	L	C	L	C	L	C	L	C	L	C	L	C	L
Dam Failure	C	L	C	L	C	L	C	L	C	L	C	L	C	L
Drought	NC	L	NC	L	NC	L	C	M	C	M	C	M	NC	L
Earthquakes	NC	L	NC	L	NC	L	NC	L	NC	L	NC	L	NC	L
Expansive Soils	NC	L	NC	L	NC	L	NC	L	NC	L	NC	L	NC	L
Extreme Heat	NC	L	NC	L	NC	L	NC	L	NC	M	NC	M	NC	L
Flooding	C	H	C	H	C	H	C	H	NC	M	NC	M	C	H
Hurricanes	C	M	C	M	C	M	C	M	C	M	C	M	C	M
Landslides	NC	L	NC	L	NC	L	NC	L	NC	L	NC	L	NC	L
Northeasters	C	H	C	H	C	H	C	H	C	H	C	H	C	H
Thunderstorms	NC	H	NC	H	NC	H	NC	H	NC	H	NC	H	NC	H
Tornadoes	C	M	C	M	C	M	C	M	C	M	C	M	C	M
Wildfire	C	H	C	H	C	H	C	L	C	H	C	H	C	H
Winter storms	C	H	C	H	C	H	C	H	C	H	C	H	C	H

4.2 Community Specific Hazard Identification

Like many communities in the United States, the communities within the RADCO region are subject to a number of natural hazards. Some of these hazards have a measurably higher chance of occurring in any given year (recurrence interval) than do others based on historical records of occurrence. Since the advent of federal, modern-era disaster assistance programming in 1969, the Commonwealth of Virginia has had 30 Presidential Disaster Declarations (including the declaration for the impacts of Hurricane Isabel in September 2003). Of these 30 declarations, 22 have been flood events (with several floods spawned by hurricanes); six were winter weather events (snow/ice/extreme cold), one for tornadoes and another for the terrorist attacks at the Pentagon in Arlington on September 11, 2001.

The following sections present a detailed assessment of critical hazards that affect each RADCO community. Understanding these hazards will assist the RADCO region in its process of identifying specific risks and developing a mitigation strategy to address those risks.

4.2.1 Caroline County, including Town of Bowling Green and Town of Port Royal, Hazard Identification

The HMPC representatives for Caroline County, the Town of Bowling Green, and the Town of Port Royal performed a two-stage evaluation of identified natural hazards affecting their communities. First, the hazards were grouped into two categories; critical and non-critical hazards. Secondly, in conjunction with the consulting team, each critical hazard was ranked based on the threat posed to its citizens (Table 4.2.1a). Hazards that ranked critical with a medium to high hazard level were then investigated further and a vulnerability analysis was performed.

Table 4.2.1a Prioritization of Natural Hazards
Caroline County, Town of Bowling Green and Town of Port Royal

Hazard type	Critical vs. Non-Critical	Probability of Occurrence
Flooding	Critical	High
Northeasters Winter Storms	Critical	High
Wildfire	Critical	High
Hurricanes	Critical	Medium
Tornadoes	Critical	Medium
Biological Hazards	Critical	Low
Dam Failure	Critical	Low
Thunderstorms	Non-Critical	High
Drought	Non-Critical	Low
Earthquakes	Non-Critical	Low
Expansive Soils	Non-Critical	Low
Extreme Heat	Non-Critical	Low
Landslides	Non-Critical	Low

Flooding

Areas of Caroline County most susceptible to flooding are low-lying areas bordering major rivers including the Mattaponi, Matta, Poni, Rappahannock, and North Anna Rivers as well as numerous streams and creeks. Flash flooding is a concern in Caroline County and developing areas can experience urban flooding. Flooding in Caroline County, including Bowling Green and Port Royal, occurs as a result of heavy rains associated with low pressure systems or thunderstorms and passing tropical storms. FEMA, under the National Flood Insurance Program (NFIP), is responsible for the creation and maintenance of flood mapping for the nation.

Caroline County

FEMA has published a Flood Insurance Study (FIS) for Caroline County, dated August 15, 1989. The Flood Insurance Rate Maps (FIRMs), which accompany this FIS, delineate the 100- and 500-year flood hazard boundaries for flooding sources identified in areas of growing development or areas predicted to have future development, at the time of the report. The FIRM Index for Caroline County is provided in Appendix B. Individual FIRM panels are available at the FEMA Map Service Center (http://msc.fema.gov/). The Mattaponi River, Matta River, Poni River, and North Anna River are included in the FEMA FIS. That is, FEMA has performed detailed engineering analyses on these streams and as a result of these analyses, has developed base flood elevations and a floodway. Other streams within the County were studied by FEMA by approximate methods. These streams have a 100-year flood hazard boundary, but flood elevations and floodways have not been calculated. Significant floods from the FEMA FIS measured on the Mattaponi River in Caroline County are listed in Table 4.2.1b.

Table 4.2.1b
Summary of Significant Flood Events – Caroline County

Year of flood	Discharge * (cfs)	Max. Elevation (ft.)	Recurrence Interval (years)
August 23, 1969	12,300	36.4	30
June 25, 1972	16,900	36.4	50

* Data taken for the USGS gaging station (01674500) on the Mattaponi River, near Beulahville
Source: FEMA 1989

Town of Bowling Green

Flooding has not significantly affected the Town of Bowling Green. The Town does not currently participate in the National Flood Insurance Program and has not had a Flood Insurance Study completed for the area inside the Town's corporate limits or the associated Flood Insurance Rate Map.

Town of Port Royal

Port Royal's location along the shores of the Rappahannock River would suggest that the Town is affected by river flooding, and potentially affected by interior stream/drainage flooding problems, from time to time. Similar to the Town of Bowling Green, the Town of Port Royal does not currently participate in the National Flood Insurance Program. The Town is currently listed in the FEMA Community Status Book for the Commonwealth of Virginia as a community with an identified flood hazard that is not participating in the NFIP.

The Town of Port Royal does have a Flood Insurance Rate Map that has identified a flood hazard area. The Town's FIRM is dated July 22, 1977. In 1978, the Town made a decision not to participate in the NFIP, and therefore on July 22, 1978, one year after the Town's FIRM was developed, the Town's eligibility for inclusion in the program expired since no floodplain management ordinance was established. The map developed for the Town only demonstrates the Town's floodplain as delineated through approximate methods. At present, the Town challenges the FEMA floodplain delineation on its map, and

as such, does not participate in the NFIP. Additionally, no Flood Insurance Study was produced. The FIRM Index for the Town of Port Royal is provided in Appendix B.

In addition to FEMA, the National Climactic Data Center (NCDC) tracks the occurrence of natural hazard events across the County (Table 4.2.1c).

Table 4.2.1c
Historic Flood Events – Caroline County
Town of Bowling Green and Town of Port Royal

Date	Type	Property Damage ($)	Descriptions
July 28, 2000	Flash Flood	NA	Heavy rain caused flooding on several secondary roads near Sparta.
March 20, 2003	Flood	NA	Numerous roads closed across the area due to high water. Roads closed included German School Road, Route 781, Route 615, Route 606, Route 644, Route 613, Route 658, Route 698, and Route 611.

Source: National Climatic Data Center, 2005.

The probability of future occurrences is ranked as high. A 100-year event has a one percent probability of occurring in any given year. The 100-year floodplains for Caroline County and the Town of Port Royal have been identified and are presented in the FIRM index and FIRM panel, respectively, in Appendix B.

Northeasters and Winter Storms

In evaluating the localized threat of northeasters and winter storms to the Caroline County (including the Towns of Bowling Green and Port Royal), the HMPC analyzed local NOAA severe weather data from 1950 to 2005 to identify storms that may have posed a threat to the community. These past occurrences are presented in Table 4.2.1d. Locally, the 33 northeasters and winter storms have caused:

- Excessive snow, sleet, and freezing rain;
- Multiple traffic accidents and delays;
- Tree and property damage;
- Power outages; and
- Injury to human life.

A noted ice storm occurring during 1993 caused a power outage in Caroline County that lasted for several weeks.

The probability of future occurrences is ranked as medium. With 33 events occurring between 1993 and 2004, the City of Fredericksburg experiences approximately three winter events per year.

Wildfire

In evaluating the localized threat of wildfires to Caroline County (including the Towns of Bowling Green and Port Royal), the HMPC analyzed data documented by the Virginia Department of Forestry. These data included wildfires that occurred between the years 1995-2001 with a total number of acres burned, forest or non-forest, greater than 1 acre. Fires occurring on federal lands were not included. These past occurrences are presented in Table 4.2.1e. Locally, the 77 wildfires have burned over 535 acres, with only one (1) incident resulting in a burn of over 40 acres. Based on information from 1995-2001, Caroline County averages 12.8 wildfires per year. Therefore, the probability of future occurrences is ranked as high.

Hurricanes

In evaluating the localized threat of hurricanes to Caroline County (including the Towns of Bowling Green and Port Royal), the HMPC analyzed NOAA hurricane track data from 1851 to 2004 to identify storms that may have posed a threat to the communities. The analysis included hurricanes, tropical storms, tropical depressions, and extratropical storms, which passed through the region and the effects on the local community. These past occurrences are presented in Table 4.2.1f. Locally, the eleven (11) hurricanes have caused:

- Heavy rain;
- Gusty and high sustained winds;
- Flooding and property damage; and
- Multiple power outages.

The probability of future occurrences is ranked as medium. With 11 hurricanes occurring between 1954 and 2004, Caroline County experiences approximately 0.22 hurricanes per year.

Tornadoes

In evaluating the localized threat of tornadoes to Caroline County (including the Towns of Bowling Green and Port Royal), the HMPC analyzed local emergency management data and NOAA severe weather data from 1950 to 2005 to identify storms that may have posed a threat to the community. Most tornado activity occurred from May to September, although a historic event in February was noted. These past occurrences are presented in Table 4.2.1g. Locally, the seven (7) tornadoes have caused:

- Property damage, including the destruction of mobile homes;
- Tree damage and resultant power outages; and
- Loss of life.

The probability of future occurrences is ranked as medium. With 7 tornadoes occurring between 1975 and 2004, Caroline County experiences approximately 0.24 tornadoes per year.

Table 4.2.1d
Historic Northeaster and Winter Storm Events – Caroline County
Town of Bowling Green and Town of Port Royal

Date	Event	Property Damage ($)	Comments
December 28, 1993	Heavy Snow	0	
January 28, 1995	Heavy Snow	0	
January 11, 1996	Heavy Snow	0	▪ The second storm in less than a week dumped locally heavy snow again on portions of central and east central Virginia. Further south and southeast, the precipitation was somewhat lighter, and more in the form of sleet and freezing rain.
February 2, 1996	Winter Storm	0	▪ A vigorous upper level jet stream induced low-level lifting of warm moist air over a stationary arctic front extending from Tidewater Virginia through the Tennessee Valley early on the 2nd, producing a 75 mile-wide band of heavy snow which extended from the central piedmont through the Northern Neck region. ▪ The heaviest snows fell in a narrow band from northern Albemarle Co through King George Co. Accumulations in these areas ranged from 8 to 13 inches, and snowfall rates were as high as 3 inches per hour.
February 16, 1996	Winter Storm	0	▪ A strong "Alberta Clipper", diving southeast from the upper midwest into the deep south, linked up with subtropical moisture lurking along the southeast U.S. coast to develop a classic nor'easter, which moved from northeast South Carolina to off the Virginia Capes during the day on the 16th. As the area of low pressure intensified, it wrapped Atlantic moisture well to the west, where modified arctic air was pouring in from southern Canada. The result was a thin band of heavy snow which extended from southwest Virginia through the upper eastern shore of Maryland.
March 1, 1996	Winter Storm	0	▪ A low pressure are tracked northeast from the Gulf of Mexico to off the North Carolina coast. It spread light snow across portions of eastern and central Virginia from the northern neck and middle peninsula westward into the piedmont.
March 7, 1996	Winter Storm	0	▪ A low pressure area developed over the Carolinas then tracked northeast off the North Carolina and Virginia coast. It spread light snow across much of central and eastern Virginia from Thursday night through Friday morning.
February 8, 1997	Heavy Snow	25K	▪ A winter storm dumped 4 to 8 inches of heavy, wet snow across all of northern and western Virginia on the 8th. ▪ Low pressure tracked from the Gulf Coast States to off the North Carolina coast during Friday, February 7th and Saturday, February 8th. It spread 2 to 3 inches of snow across portions of the central piedmont eastward to the northern neck of Virginia. While across northern portions of Caroline, Fluvanna, Louisa, and Westmoreland counties, 4 to 5 inches of snow accumulated.

Table 4.2.1d
Historic Northeaster and Winter Storm Events – Caroline County
Town of Bowling Green and Town of Port Royal

Date	Event	Property Damage ($)	Comments
December 23, 1998	Ice Storm	20M	▪ A major ice storm affected central and eastern Virginia from Wednesday, December 23rd into Friday, December 25th. A prolonged period of freezing rain and some sleet resulted in ice accumulations of one half inch /0.50/ to one inch /1.00/ in many locations. The heavy ice accumulations on trees and power lines caused widespread power outages across the region. Approximately 400,000 customers were without power during the maximum outage period, Christmas Eve day. Some customers were without power for about ten days. Many accidents occurred due to slippery road conditions, especially bridges and overpasses. Many secondary roads were impassable due to fallen tree limbs and in a few cases, whole trees.
January 8, 1999	Winter Weather	0	▪ Sleet, freezing rain and freezing drizzle occurred off and on during Friday, January 8th across portions of the piedmont of central Virginia into the Virginia northern neck. This precipitation resulted in ice accumulations on many roads and bridges, and in turn, several accidents were reported.
January 15, 1999	Winter Weather	0	▪ A strong arctic cold front moved slowly southeast across the Mid-Atlantic region from late on the 13th to midday on the 15th. By 9am on the 15th, ice accumulations from one quarter to nearly one inch occurred north of a line from Augusta County to Spotsylvania County. The ice this storm left behind had a large impact on the region. Hundreds of car accidents, slip and fall injuries, downed trees, and power outages were reported. In Stafford County, a jackknifed tractor trailer closed State Route 3 and 621, and Interstate 95 had to be temporarily shut down to clear fallen trees. Over 215,000 customers lost power from the storm across Northern Virginia, and Central Virginia reported over 6,000 additional outages.
March 9, 1999	Winter Storm	0	▪ An area of low pressure moved from the Ohio Valley to North Carolina from late on the 8th through the evening of the 9th. Snowfall rates were in excess of 1 1/2 inches per hour in many locations during the storm. Stafford County received between 4 to 8 inches. Spotsylvania and King George County received between 2 and 6 inches. The City of Fredericksburg reported over 100 accidents. On Interstate 95 in Spotsylvania County, a woman was killed in a morning car accident. ▪ The combination of a weakening storm over the Ohio Valley, and a developing storm off the South Carolina coast produced 2 to 5 inches of snow across portions of the Virginia piedmont eastward into the Virginia northern neck Tuesday afternoon into early morning Wednesday. Beaverdam in Hanover county and Hague in Westmoreland county received 5 inches of snow. Ruther Glen in Caroline county and King and Queen in King and Queen county received 4 inches of snow.
January 19, 2000	Winter Storm	0	▪ An area of low pressure moved from west to east across the Mid-Atlantic region on the 20th, dropping 2 to 6 inches of snow between midnight and mid-afternoon. Gusty winds of 35 to 45 MPH developed during the afternoon causing the snow to drift across roadways and reduce visibilities in open areas.

Table 4.2.1d
Historic Northeaster and Winter Storm Events – Caroline County
Town of Bowling Green and Town of Port Royal

Date	Event	Property Damage ($)	Comments
			▪ Two to three inches of snow fell overnight as an area of low pressure passed south of the region. The highest amounts were measured along a line from Caroline county in the north, through the city of Richmond, then along the southern shore of the James River to near the Newport News area. Snow briefly fell heavily after midnight, creating hazardous driving conditions.
January 25, 2000	Winter Storm	0	▪ A significant winter storm dumped over one foot of snow across much of central and eastern Virginia, with isolated amounts of up to 19 inches reported. There was also significant blowing and drifting of snow as winds gusted over 30 mph during the storm. The Richmond International Airport was closed during this storm. A very cold air mass built into the region after the storm, preserving the snowpack for over a week in many areas. Snow drifts of 3 to 5 feet were reported, especially in the south central Virginia counties of Dinwiddie, Brunswick, and Mecklenburg. Specific county totals were: Mecklenburg county 13 to 16 inches, Lunenburg county 13 to 14 inches, Brunswick county 12 inches, Nottoway county 12 to 15 inches, Dinwiddie county including Petersburg city 14 to 18 inches, Prince George county including Hopewell 10 to 15 inches, Chesterfield county including Colonial Heights 9 to 15 inches, Charles City county 15 inches, Henrico county including Richmond city 10 to 12.5 inches, New Kent county 16 inches, Hanover county 9 to 12 inches, King William county 12 to 16 inches, King and Queen county 14 to 16 inches, Caroline county 12 inches, Essex county 16 to 17 inches, Richmond county 11 to 12 inches, Westmoreland county 12 to 13 inches, and Northumberland county 12 inches.
January 30, 2000	Ice Storm	465K	▪ Cold air was in place east of the Blue Ridge Mountains on the 29th and 30th, keeping surface temperatures below freezing. Low pressure moved from the Lower Mississippi Valley northeastward to the Mid-Atlantic region early on the 30th, creating the perfect conditions for freezing rain around the Fredericksburg area, a mix of sleet and snow east of Skyline Drive, and moderate snowfall in the mountains. Ice accumulations between 1/4 and 3/4 of an inch coated roads, trees, and power lines in Fredericksburg and Stafford, Spotsylvania, and King George Counties. Electrical outages were reported as trees and branches weighed down by ice fell onto power lines. Disruptions affected 3000 customers in Fredericksburg and Spotsylvania and King George Counties. At one point, 300,000 people were without power in the Richmond vicinity due to the weight of ice downing trees and power lines. One Richmond TV station was knocked off the air for 45 minutes Two people were reported injured in Richmond; one while cutting downed trees with a chainsaw, another in a sledding accident.
February 12, 2000	Winter Storm	0	▪ A low pressure system tracked eastward from the Ohio valley and spread mainly light snow, sleet, and freezing rain across portions of central and eastern Virginia. Accumulations ranged from one to two inches, with one report of three inches of snow received from southern Louisa county. Warmer air moved in during the late afternoon and changed the precipitation over to rain.
February 22, 2001	Winter Storm	0	▪ This system produced mainly light to moderate snowfall across the region between 9 AM and 10 PM. Snowfall amounts ranged from 2 to 5 inches. A 50 vehicle crash occurred on the northbound lanes near Masaponax in Spotsylvania County. The accident occurred as motorists crested the

Table 4.2.1d
Historic Northeaster and Winter Storm Events – Caroline County
Town of Bowling Green and Town of Port Royal

Date	Event	Property Damage ($)	Comments
			top of a hill, hit near zero visibility, and slammed on their breaks. Three people were treated for serious injuries and another 18 suffered minor injuries. The highway remained closed for three hours while the wreckage was cleared. A 30 vehicle pileup occurred on the southbound lanes just north of the Falmouth/Route 17 interchange in Stafford County. As whiteout conditions struck, three cars slid into each other. Within seconds, the minor fender bender turned into a pileup including tractor trailers, cars, trucks, and an empty bus. Three people were injured and the highway was blocked for nearly three hours.
January 2, 2002	Winter Storm	0	▪ A winter storm produced 5 to 8 inches of snow across the piedmont of central Virginia, the Virginia northern neck, the middle peninsula, and the Virginia eastern shore. Some specific higher snow totals included: City of Richmond 7-8", City of Colonial Heights 8", Gloucester Point in Gloucester county 8", Mechanicsville in Hanover county 8", Nassawadox in Northampton county 8", Parksley in Accomack county 7", and Ruther Glen in Caroline county 7.5". Local law enforcement agencies reported numerous accidents. Most, if not all schools in the area, were closed Thursday, January 3rd and Friday, January 4th due to very slippery road conditions.
January 19, 2002	Winter Storm	0	▪ Low pressure that moved across North Carolina on the 19th brought mixed precipitation to the region between 6 AM and 11 PM. In most locations, the precipitation started off in the form of snow, then changed to a mix of sleet and rain around midday. ▪ A winter storm produced a mixture of snow, sleet, and freezing rain across portions of central Virginia. Snowfall totals were 2 to 4 inches, except up to 5 inches occurred in parts of Fluvanna county. Local law enforcement agencies reported numerous accidents due to very slippery road conditions.
December 4, 2002	Winter Storm	0	▪ A winter storm produced 4 to 7 inches of snow along with less than 1/4 inch of ice across the piedmont of central Virginia and the Virginia northern neck. Some specific higher snow totals included: Louisa in Louisa county 7", Cumberland in Cumberland county 6", Goochland in Goochland county 5.5", Blackstone in Nottoway county 6", Ruther Glen in Caroline county 5", Farmville in Prince Edward county 5", Powhatan in Powhatan county 5.5", Palmyra in Fluvanna county 5", Amelia in Amelia county 5", Ashland in Hanover county 4.5", King William in King William county 5", Tappahannock in Essex county 5", and Montross in Westmoreland county 4". Local law enforcement agencies reported numerous accidents. Most, if not all schools in the area, were closed Thursday, December 5th and Friday, December 6th due to very slippery road conditions.
December 11, 2002	Winter Weather/mix	0	▪ Freezing rain caused minor ice accumulations on trees, power lines, bridges and overpasses across portions of the central Virginia Piedmont. A few power outages and accidents were reported.
January 6, 2003	Winter Weather/mix	0	▪ A weak winter storm produced only a dusting to 1 inch of snow across portions of central and eastern Virginia. Some specific snow totals included: City of Hampton 1", Eastern Newport News 1", City of Suffolk 1", City of Norfolk 0.5", Pembrooke area of Virginia Beach 0.5", Gloucester in

Table 4.2.1d
Historic Northeaster and Winter Storm Events – Caroline County
Town of Bowling Green and Town of Port Royal

Date	Event	Property Damage ($)	Comments
			Gloucester county 0.5", and Ruther Glen in Caroline county 0.5". Accumulations from this storm were mostly on cars and grassy areas, with roadways remaining generally wet although some slush was reported.
January 14, 2003	Winter Weather/mix	0	A weak winter storm produced one half (0.5) to one and one half (1.5) inches of snow across portions of the Virginia northern neck, middle peninsula, and Hampton Roads area. Some specific snow totals included: Kilmarnock in Lancaster county 1.5", Saluda in Middlesex county 1.5", King and Queen in King and Queen county 1-1.5", City of Newport News 1", City of Williamsburg 1", Ruther Glen in Caroline county 0.75", and Wallops Island in Accomack county 0.5".
January 16, 2003	Winter Storm	0	▪ A winter storm produced 4 to 8 inches of snow across portions of central and eastern Virginia. Some specific higher snow totals included: Toano in James City county 8", Northern portion of York county 8", Gloucester in Gloucester county 7", Deltaville in Middlesex county 6.5", Mathews in Mathews county 6.5", Chincoteague in Accomack county 6", City of Newport News 6", Eastville in Northampton county 5.5", City of Hampton 5", City of Williamsburg 5", Surry in Surry county 5", West Point in King and Queen county 5", and Mangohick in King William county 5". Local law enforcement agencies reported numerous accidents. Most, if not all schools in the area, were closed Friday, January 17th due to very slippery road conditions.
January 30, 2003			▪ A winter storm produced 3 to 5 inches of snow across portions of central Virginia. Some specific higher snow totals included: Crewe in Nottoway county 5", Farmville in Prince Edward county 4", Trenholm in Powhatan county 4", Gum Spring in Louisa county 4", Montpelier in Hanover county 4", Fife in Goochland county 4", Ashby in Cumberland county 4", and Ruther Glen in Caroline county 4". Local law enforcement agencies reported numerous accidents. Most, if not all schools in the area, were dismissed early on Thursday, January 30th due to very slippery road conditions.
February 6, 2003	Winter Storm	0	▪ Low pressure tracked from the Gulf Coast to the Carolinas on the 6th then off the Atlantic coast on the 7th. This storm dropped light to moderate snow between the evening of the 6th and Noon on the 7th. Accumulations ranged from 3 to 7 inches. ▪ A winter storm produced 4 to 7 inches of snow across the piedmont of central Virginia and the Virginia northern neck. The higher snow amounts occurred in Caroline, Cumberland, Essex, Fluvanna, Goochland, Hanover, and Louisa counties. Local law enforcement agencies reported numerous accidents. Most, if not all schools in the area, were closed Friday, February 7th due to very slippery road conditions.
February 10, 2003	Winter Weather/mix		▪ A weak winter storm produced 0.5 to 1 inch of snow across portions of the piedmont of central Virginia and the Virginia northern neck. Although, Louisa county reported 2 to 3 inches of snow. Accumulations from this storm were mostly on cars and grassy areas, with roadways remaining generally wet although some slush was reported.
February 15, 2003	Winter Storm	0	▪ A complex storm system produced copious amounts of wintery precipitation across the northern third of Virginia between the evening of the 14th and midday on the 18th. After the precipitation came to an end, record breaking snow and sleet accumulations were reported.

Table 4.2.1d
Historic Northeaster and Winter Storm Events – Caroline County
Town of Bowling Green and Town of Port Royal

Date	Event	Property Damage ($)	Comments
			▪ A winter storm produced 4 to 9 inches of snow, along with sleet and freezing rain, across central and eastern Virginia. Some specific higher snow totals included: Ruther Glen in Caroline county 9", Dunnsville in Essex county 8", Louisa in Louisa county 8", Newland in Richmond county 8", Heathsville in Northumberland county 7.5", Amelia in Amelia county 6.5", King William in King William county 6.5", Palmyra in Fluvanna county 6", Montross in Westmoreland county 6", Lancaster in Lancaster county 5.5", Northern Accomack county 5", Midlothian in Chesterfield county 5", Goochland in Goochland county 5", and Doswell in Hanover county 5". Local law enforcement agencies reported numerous accidents. Most, if not all schools in the area, were closed Monday, February 17th due to very slippery road conditions.
February 26, 2003	Winter Storm	0	▪ A series of low pressure systems that tracked from the Gulf Coast to Cape Hatteras dropped light snow off and on between the morning of the 26th and midday on the 28th. A total of 5 to 8 inches of snow accumulated across the northern third of Virginia during the storm. Minor traffic accidents were reported after the fallen snow made roads slippery. ▪ A winter storm produced 1 to 4 inches of snow, along with sleet and 1/8 to 1/2 inch of ice accumulation, across central and eastern Virginia. Some specific higher snow totals included: Ruther Glen in Caroline county 4.5", Bowling Green in Caroline county 3", West Point in King William county 3", Reedville in Northumberland county 3", Beaverdam in Hanover county 2.5", Louisa in Louisa county 2-3", and Montross in Westmoreland county 2-3". Local law enforcement agencies reported numerous accidents. Most, if not all schools in the area, were closed Thursday, February 27th due to very slippery road conditions.
December 14, 2003	Winter Storm	0	▪ An area of low pressure developed over the Gulf Coast region and tracked northeast into the Mid Atlantic region. The storm produced a mixture of snow, sleet and freezing rain. Snowfall totals across Northeast Virginia averaged 3 to 4 inches. ▪ One to four inches of snow, and 1/4 to 1/2 inch of ice due to freezing rain, occurred across portions of central Virginia. The freezing rain on power lines resulted in scattered power outages, and roadways were very slippery.
January 25, 2004	Winter Storm	0	▪ An area of low pressure developed off the coast of North Carolina and tracked north. This storm produced widespread snow, sleet and freezing drizzle over the region. Two to four inches of snow fell over the Central Foothills and the Northern Piedmont of Virginia. The snow mixed with sleet and finally changed over to freezing drizzle before tapering off. Several other minor accidents occurred according to Emergency Operations Centers. Dozens of school districts closed. ▪ Four to as much as six inches of snow and sleet fell across portions of central Virginia. Some higher amounts included: Farmville in Prince Edward county 6", Cumberland in Cumberland county 6", Montpelier in Hanover county 6", Columbia in Fluvanna county 5", Goochland in Goochland county 5", Glen Allen in Henrico county 5", and Tappahannock in Essex county 5". The snow and sleet produced very slippery roadways, which resulted in numerous accidents and school closings for a few days.

Table 4.2.1d
Historic Northeaster and Winter Storm Events – Caroline County
Town of Bowling Green and Town of Port Royal

Date	Event	Property Damage ($)	Comments
February 17, 2004	Winter Weather/mix	0	▪ One half inch to two inches of snow fell across portions of central Virginia and the Virginia northern neck. The snow produced slippery roadways, which resulted in a few accidents.
December 19, 2004	Winter Weather/mix	0	▪ One half inch to as much as three inches of snow fell across central and eastern Virginia. The snow produced slippery roadways, which resulted in several accidents. The highest amounts were reported at Lawrenceville in Brunswick county 3", Montross in Westmoreland county 3", South Hill in Mecklenburg county 2", and Sandston in Henrico county 2".

Source: National Climatic Data Center, 2005.

Table 4.2.1e
Historic Wildfire Events – Caroline County
Town of Bowling Green and Town of Port Royal

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
02/23/1995	2	20	0	Debris Burning
03/13/1995	3	0	0	Debris Burning
03/13/1995	2	0	0	Smoking
03/16/1995	2	0	0	Incendiary
03/17/1995	2	0	0	Debris Burning
03/18/1995	2	75	0	Smoking
03/22/1995	3	0	0	Debris Burning
03/26/1995	2	0	0	Smoking
04/05/1995	7	0	0	Smoking
04/25/1995	1	0	0	Equipment Use
03/24/1996	2	0	0	Children
07/10/1996	13	0	0	Incendiary
02/20/1997	1	0	0	Railroad
02/27/1997	1	0	0	Incendiary
04/01/1997	18	0	0	Smoking
04/04/1997	1	0	0	Incendiary
04/04/1997	1	0	0	Incendiary
06/26/1997	2	0	0	Equipment Use
10/10/1997	3	0	0	Smoking
12/20/1997	3	0	0	Smoking
03/15/1998	1	0	0	Children
03/28/1998	22	0	0	Smoking
04/03/1998	28	0	0	Lightning
04/05/1998	1	0	0	Equipment Use
07/02/1998	1	0	0	Children
07/06/1998	3	0	0	Debris Burning
07/07/1998	1	0	0	Miscellaneous
07/07/1998	1	0	0	Smoking
07/20/1998	2	0	0	Incendiary
08/06/1998	1	0	200	Incendiary
09/05/1998	3	0	0	Smoking
09/05/1998	1	0	0	Smoking
09/07/1998	1	0	0	Smoking
09/07/1998	30	0	0	Miscellaneous
09/12/1998	1	0	0	Smoking
10/02/1998	1	0	0	Smoking
11/16/1998	1	0	0	Incendiary
11/29/1998	4	0	0	Debris Burning
11/30/1998	5	500	0	Smoking
12/06/1998	1	0	0	Smoking
12/08/1998	6	0	0	Incendiary
01/29/1999	2	0	0	Debris Burning
03/07/1999	3	0	0	Smoking
03/17/1999	14	0	0	Debris Burning
03/18/1999	1	0	0	Children
04/08/1999	145	0	0	Miscellaneous
04/28/1999	3	0	0	Incendiary
05/01/1999	13	0	0	Miscellaneous

Table 4.2.1e
Historic Wildfire Events – Caroline County
Town of Bowling Green and Town of Port Royal

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
05/10/1999	2	0	0	Debris Burning
05/11/1999	1	0	0	Children
05/22/1999	3	0	0	Smoking
06/01/1999	1	0	0	Debris Burning
11/08/1999	3	0	0	Smoking
01/01/2000	1	0	0	Incendiary
05/19/2000	1	0	0	Miscellaneous
06/13/2000	3	0	0	Miscellaneous
10/31/2000	1	0	0	Debris Burning
11/07/2000	7	0	0	Debris Burning
12/05/2000	6	0	0	Railroad
01/04/2001	11	0	0	Debris Burning
01/30/2001	18	0	0	Debris Burning
02/06/2001	13	0	100	Debris Burning
02/08/2001	1	0	0	Miscellaneous
02/21/2001	1	0	0	Miscellaneous
02/21/2001	5	0	0	Debris Burning
03/14/2001	1	0	0	Smoking
03/16/2001	3	0	0	Miscellaneous
03/26/2001	1	0	0	Railroad
05/02/2001	1	0	0	Children
05/14/2001	15	0	0	Debris Burning
10/24/2001	3	0	0	Debris Burning
10/27/2001	3	0	0	Incendiary
10/27/2001	6	500	0	Debris Burning
10/27/2001	37	0	0	Equipment Use
10/28/2001	1	0	0	Debris Burning
11/05/2001	6	0	0	Incendiary
11/20/2001	13	0	0	Incendiary
Totals	**535**	**$1,095**	**$300**	

Source: Virginia Department of Forestry, 2005.

Table 4.2.1f
Historic Hurricane Events – Caroline County
Town of Bowling Green and Town of Port Royal

Storm Name	Date	Category	Total Est. Damage	Descriptions
Hazel	October 15, 1954	Hurricane	Unknown	▪ The Free-Lance Star reported flooding and property damage.
Connie	August 12, 1955	Hurricane	Unknown	▪ The Free-Lance Star reported flooding and property damage.
Diane	August 17, 1955	Hurricane	Unknown	▪ The Free-Lance Star reported flooding and property damage.
Camille	September 1960	Hurricane	Unknown	▪ The Free-Lance Star reported massive flooding.
Floyd	September 16, 1999	Tropical Storm	No estimate available.	▪ Gusty winds from 30 to 50 mph ▪ 2 to 5 inches of rain ▪ 16,000 power outages
Isabel	September 18, 2003	Tropical Storm	$55.1 million – property $130,000 – crop	▪ Highest sustained wind was73 mph ▪ Uprooted thousands of trees and downed numerous power lines ▪ Over 2 million Virginians without power
Charley And Bonnie	August 18, 2004	Hurricane	Unknown	▪ Highest sustained wind was 73 mph ▪ Uprooted trees and downed numerous power lines ▪ Over 2 million Virginians without power ▪ Heavy rain and wind gust
Frances	September 8, 2004	Hurricane	Unknown	▪ Generated 9 tornadoes in Central Virginia ▪ High winds ▪ Large amounts of rainfall/flooding
Ivan	September 17, 2004	Hurricane	Unknown	▪ Spawned unconfirmed tornadoes ▪ Power outage (66,000) ▪ Heavy rain/flooding
Jeanne	September 28, 2004	Hurricane	Unknown	▪ Flash flooding/heavy rainfall ▪ Power outage
Gaston	August 30, 2004	Tropical Depression	Unknown	▪ Hard rains that processed flooding ▪ Roads under water ▪ Power outage (99,600 statewide)

Source: NOAA 2004, VWC 2004, and local emergency management.

Table 4.2.1g
Historic Tornado Events – Caroline County
Town of Bowling Green and Town of Port Royal

Date	Magnitude	Property Damage ($)	Descriptions
March 24, 1975	F1	25K	NA
July 8, 1977	F0	25K	NA
August 12, 1977	F0	25K	NA
June 26, 1988	F0	0K	NA
April 1, 1998	F2	200K	▪ Supercell thunderstorm produced a tornado along a 9 mile path extending from near Coatesville in northwest Hanover County eastward into south central Caroline county southeast of Ruther Glen. The damage path was nearly continuous along this track, with damage intensity ranging from F0/F1 to strong F2/F3. Damage path ranged from approximately 200 yards wide to near one quarter of a mile wide at its widest. ▪ Two mobile homes were destroyed in Caroline county. Several churches sustained damage, and several outbuildings were severely damaged or destroyed. ▪ One minor injury in Caroline county.
September 8, 2004	F1	25K	▪ Town of Bowling Green - F1 tornado damaged or destroyed several buildings. Numerous trees downed or sheared. ▪ This tornado tracked into King George County.
September 17, 2004	F1	500K	▪ F1 tornado downed numerous trees near Cosbys Corner. Many trees snapped off 10 feet above ground level. Cinderblock detached garage (30 x 32 foot) totally destroyed. Two vehicles damaged, minor damage to home, and mobile home destroyed by falling tree. ▪ F1 tornado downed numerous trees on Friendship Road. Many trees snapped off 10 feet above ground level. One tree fell on a house and caused significant damage. ▪ Town of Port Royal - F1 tornado downed numerous trees near the intersection of Route 615 and Route 728 around Four Winds Golf Course. Many trees snapped off about 10 feet above ground level, and significant damage to 2 homes.

Source: National Climatic Data Center, 2005; NA = Data not available.

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4.2.2 City of Fredericksburg Hazard Identification

The HMPC representatives for the City of Fredericksburg performed a two-stage evaluation of identified natural hazards affecting their community. First, the hazards were grouped into two categories; critical and non-critical hazards. Secondly, in conjunction with the consulting team, each critical hazard was ranked based on the threat posed to its citizens (Table 4.2.2a). Hazards that ranked critical with a medium to high hazard level were then investigated further and a vulnerability analysis was performed.

Table 4.2.2a Prioritization of Natural Hazards
City of Fredericksburg

Hazard type	Critical vs. Non-Critical	Probability of Occurrence
Flooding	Critical	High
Northeasters Winter Storms	Critical	High
Drought	Critical	Medium
Hurricanes	Critical	Medium
Tornadoes	Critical	Medium
Biological Hazards	Critical	Low
Dam Failure	Critical	Low
Wildfire	Critical	Low
Thunderstorms	Non-Critical	High
Earthquakes	Non-Critical	Low
Expansive Soils	Non-Critical	Low
Extreme Heat	Non-Critical	Low
Landslides	Non-Critical	Low

Flooding

Flooding is one of the most significant natural hazards faced by the City of Fredericksburg. The primary source of floodwaters affecting the City is riverine flooding from the Rappahannock River that occurs in conjunction with heavy rains associated with hurricanes, tropical storms and northeasters. Urban and flash flooding also affect the City. Flooding can occur during any season of the year. Listed in Tables 4.2.2b and 4.2.2c are the significant flood events for the City of Fredericksburg along the Rappahannock River (FEMA 1979; NOAA 2004). Areas located with the 100-year flood boundary as delineated on the FEMA FIRM are at risk of flooding. Low-lying areas that border streams and creeks are particularly at risk. Any area where waters can pond due to obstruction to the stormwater system are also susceptible to flooding.

FEMA published a Flood Insurance Study (FIS) for the City of Fredericksburg dated January 1979. The Flood Insurance Rate Maps (FIRMs), which accompany this FIS, delineate the 100- and 500-year flood hazard boundaries for flooding sources within the City limits. The FIRM Index for the City of Fredericksburg is provided in Appendix B. Individual FIRM panels are available at the FEMA Map Service Center (http://msc.fema.gov/). The FIS states that the 100-year base flood elevations for the Rappahannock River range from approximately 38 to 45 feet (referenced to the National Geodetic

Vertical Datum, 1929). In addition, this study established a floodway for the Rappahannock River for its entire reach within the City.

Table 4.2.2b
FIS - Summary of Significant Flood Events – City of Fredericksburg

Flood	Discharge [1] (cfs)	Frequency Interval [1] (yrs)	* Crest [2] (ft)
May 27, 1771	N/A	N/A	--
June 1, 1889	96,000	45	32.2
May 23, 1901	N/A	N/A	27.2
May 13, 1924	66,900	16	25.1
October 1, 1924	N/A	N/A	22.8
April 26, 1937	134,000	125	39.1
October 16, 1942	140,000	145	42.6
August 19, 1955	N/A	N/A	26.9
June 22, 1972	107,000	60	39.1
June 29, 1995	N/A	N/A	25.1
September 8, 1996	N/A	N/A	26.9

[1] City of Fredericksburg Flood Insurance Study dated, January 1979
[2] NOAA advanced Hydrologic Prediction Service http://ahps.erh.noaa.gov/cgi-bin/ahps.cgi?lwx&fedv2#Historical
* The flood stage for the Rappahannock River is 18.0 feet

Table 4.2.2c
NCDC Historic Flood Events – City of Fredericksburg

Date	Event	Comments
September 3, 2000	Flash Flood	▪ The city of Fredericksburg was hit especially hard by flash flooding after a total of 2.24 inches of rain fell. ▪ Several residents of homes and ground floor apartments reported damaged from rapidly rising water that entered the structures through sewer systems, basement windows, and doors. ▪ Several motorists had to be rescued from their cars after driving into flooded sections of roadway. Some cars were submerged up to their windshields in water. ▪ High water blocked access to Mary Washington Hospital. ▪ A 4-foot-deep sinkhole appeared along Snowden Hills Boulevard after the deluge.
July 10, 2003	Flash Flood	▪ In Fredericksburg, an apartment building was struck by lightning. ▪ Also, two homes in Normandy Village on Woodford Street caught fire after being hit by lightning. ▪ Lightning also damaged asphalt on William Street at Sunken Road. Cowan Boulevard was closed by flooding.

Source: NOAA 2004

Noted Problem Areas

The HMPC representatives for the City of Fredericksburg noted two locations within the community where flooding was a known concern: the City Dock area and Kenmore Bottom. Within the City Dock area, located near Lower Sophia Street, structures have begun to flood prior to the Rappahannock River reaching flood stage (18 ft). During previous flood events, these structures noted flooding beginning at a stage of approximately 12 ft.

Kenmore Avenue below the University of Mary Washington, also known as the Kenmore Bottom area, is prone to flash flood events. Residents within this area have noted basement flooding, impacts to the sanitary and storm sewer systems, and restricted access within the area due to flood waters overtopping roadways.

The probability of future occurrences is ranked as high. A 100-year event has a one percent probability of occurring in any given year. The 100-year floodplains for the City of Fredericksburg have been identified and are presented in the FIRM panel in Appendix B.

Northeasters and Winter Storms

In evaluating the localized threat of northeasters and winter storms to the City of Fredericksburg, the HMPC analyzed local NOAA severe weather data from 1851 to 2004 to identify storms that may have posed a threat to the community. These past occurrences are presented in Table 4.2.2d. Locally, the 24 northeasters and winterstorms have caused:

- Excessive snow, sleet, and freezing rain;
- Multiple traffic accidents and delays;
- Tree and property damage;
- Power outages; and
- Injury and loss of life.

The probability of future occurrences is ranked as medium. With 24 events occurring between 1993 and 2004, the City of Fredericksburg experiences approximately 2.8 winter events per year.

Drought

According to the National Climatic Data Center, there have been three drought events reported in Fredericksburg between January 1, 1950 and July 30, 2005. Additionally, the HMPC representatives for the City of Fredericksburg reported recent requests to the community for voluntary reduction in water usage. These past occurrences are presented in Table 4.2.2e. Locally, droughts have caused:

- Voluntary and mandatory reductions in water usage;
- Reduction in crop yields:
- Grazing losses;
- Increase in forest and brush fires; and
- Reduction in streamflow and water table.

The probability of future occurrences is ranked as medium. According to the National Weather Service, Climate Prediction Center, drought development in the RADCO region is likely through December 2005.

Hurricanes

In evaluating the localized threat of hurricanes to the City of Fredericksburg, the HMPC analyzed NOAA hurricane track data from 1851 to 2004 to identify storms that may have posed a threat to the community. The analysis included hurricanes, tropical storms, tropical depressions, and extratropical storms which passed through the region and the affected the local community. These past occurrences are presented in Table 4.2.2f. Locally, the eleven (11) hurricanes have caused:

- Heavy rain;
- Gusty and high sustained winds;
- Flooding and property damage; and

- Multiple power outages.

The probability of future occurrences is ranked as medium. With 11 hurricanes occurring between 1954 and 2004, the City of Fredericksburg experiences approximately 0.22 hurricanes per year.

Tornadoes

In evaluating the localized threat of tornadoes to the City of Fredericksburg, the HMPC analyzed local emergency management data and NOAA severe weather data from 1950 to 2005 to identify storms that may have posed a threat to the community. Three tornado events are noted as crossing into the City limits. The most costly event occurred in 1999 and caused approximately $20,000 worth of damage. As stated in other community-specific sections numerous tornadoes have occurred across the region. These past occurrences are presented in Table 4.2.2g. Locally, the three (3) tornadoes have caused:

- Excessive winds and lightning;
- Large hail; and
- Tree and property damage.

The probability of future occurrences is ranked as medium. With three tornadoes occurring between 1999 and 2004, the City of Fredericksburg experiences approximately 0.6 tornadoes per year.

Table 4.2.2d
Historic Northeaster and Winter Storm Events – City of Fredericksburg

Date	Event	Rain Fall (in.)	Comments
December 28, 1993	Heavy Snow	0	
January 28, 1995	Heavy Snow	0	
January 9, 1996	Heavy Snow	0	▪ Low and mid-level lift ahead of an "Alberta Clipper" added insult to injury only a day after the "Blizzard of '96", dumping 4 inches of snow in a 5 hour period near the tidal Potomac River.
January 12, 1996	Heavy Snow	350K	▪ Less than one week after the crippling "Blizzard of '96", a new winter storm dumped substantial snow across northern and western Virginia. ▪ The snow changed to freezing rain and sleet along the tidal Potomac River shortly before tapering off. The changeover suppressed accumulations to 4 or 5 inches in this region. In other portions of northern Virginia, snowfall totals were as follows: in the piedmont, 5 to 7 inches; at higher elevations, 6 to 10 inches. ▪ In southern Stafford Co (VAZ055), a woman was injured when a carport collapsed. Luckily, she was protected from serious injury by the automobile, which had its windows shattered.
February 2, 1996	Heavy Snow	0	▪ A vigorous upper level jet stream induced low-level lifting of warm moist air over a stationary arctic front extending from Tidewater Virginia through the Tennessee Valley early on the 2nd, producing a 75 mile-wide band of heavy snow which extended from the central piedmont through the Northern Neck region. ▪ The heaviest snows fell in a narrow band from northern Albemarle Co through King George Co. Accumulations in these areas ranged from 8 to 13 inches, and snowfall rates were as high as 3 inches per hour.
February 2, 1996	Heavy Snow	0	▪ The continuation of a strong upper-level jet stream, combined with additional mid-level dynamics, generated surface low pressure over central Georgia by evening on the 2nd. As the low moved to near Cape Hatteras overnight, a broad area of heavy snow overspread all of northern Virginia. Areas that received 4 to 13 inches during an early morning event (on the 2nd) picked up an additional 4 to 6 inches, leaving most areas from the central piedmont through the northern neck with a grand total of 12 to 18 inches.
February 16, 1996	Heavy Snow	0	▪ A strong "Alberta Clipper", diving southeast from the upper midwest into the deep south, linked up with subtropical moisture lurking along the southeast U.S. coast to develop a classic nor'easter, which moved from northeast South Carolina to off the Virginia Capes during the day on the 16th. As the area of low pressure intensified, it wrapped Atlantic moisture well to the west, where modified arctic air was pouring in from southern Canada. The result was a thin band of heavy snow which extended from southwest Virginia through the upper eastern shore of Maryland.
February 8, 1997	Heavy Snow	25K	▪ A winter storm dumped 4 to 8 inches of heavy, wet snow across all of northern and western Virginia on the 8th.
January 14, 1999	Winter Weather	0	▪ A strong arctic cold front moved slowly southeast across the Mid-Atlantic region from late on the 13th to midday on the 15th. By 9am on the 15th, ice accumulations from one quarter to nearly one

Table 4.2.2d
Historic Northeaster and Winter Storm Events – City of Fredericksburg

Date	Event	Rain Fall (in.)	Comments
			inch occurred north of a line from Augusta County to Spotsylvania County. The ice this storm left behind had a large impact on the region. Hundreds of car accidents, slip and fall injuries, downed trees, and power outages were reported. In Stafford County, a jackknifed tractor trailer closed State Route 3 and 621, and Interstate 95 had to be temporarily shut down to clear fallen trees. Over 215,000 customers lost power from the storm across Northern Virginia, and Central Virginia reported over 6,000 additional outages.
March 9, 1999	Winter Storm	0	▪ An area of low pressure moved from the Ohio Valley to North Carolina from late on the 8th through the evening of the 9th. Snowfall rates were in excess of 1 1/2 inches per hour in many locations during the storm. Stafford County received between 4 to 8 inches. Spotsylvania and King George County received between 2 and 6 inches. The city of Fredericksburg reported over 100 accidents. On Interstate 95 in Spotsylvania County, a woman was killed in a morning car accident.
January 20, 2000	Winter Weather	0	▪ An area of low pressure moved from west to east across the Mid-Atlantic region on the 20th, dropping 2 to 6 inches of snow between midnight and mid-afternoon. Gusty winds of 35 to 45 MPH developed during the afternoon causing the snow to drift across roadways and reduce visibilities in open areas.
January 25, 2000	Northeaster	0	▪ Low pressure off Cape Hatteras rapidly intensified late on the 24th and developed into a nor'easter which tracked northward along the Eastern Seaboard on the 25th. Very heavy snow and near-blizzard conditions were seen throughout the day east of the Blue Ridge Mountains, resulting in extremely hazardous travel conditions. Wind gusts of up to 45 MPH were recorded and several roads were drifted shut by blowing snow. The governor of Virginia declared a state of emergency as the storm battered the eastern part of the state.
January 30, 2000	Ice Storm	0	▪ Cold air was in place east of the Blue Ridge Mountains on the 29th and 30th, keeping surface temperatures below freezing. Low pressure moved from the Lower Mississippi Valley northeastward to the Mid-Atlantic region early on the 30th, creating the perfect conditions for freezing rain around the Fredericksburg area, a mix of sleet and snow east of Skyline Drive, and moderate snowfall in the mountains. Ice accumulations between 1/4 and 3/4 of an inch coated roads, trees, and power lines in Fredericksburg and Stafford, Spotsylvania, and King George Counties. Electrical outages were reported as trees and branches weighed down by ice fell onto power lines. Disruptions affected 3000 customers in Fredericksburg and Spotsylvania and King George Counties.
February 12, 2000	Winter Weather	0	▪ Low pressure moved from Tennessee to the North Carolina Coast on the 12th, spreading snow across the Central Shenandoah Valley and the Northern and Central Piedmont. Periods of light snow occurred from sunrise to late afternoon with accumulations ranging from 1 to 5 inches. A period of freezing drizzle also occurred around sunset.
December 13, 2000	Winter Weather	0	▪ A strong cold front brought chilly air into the region on the 12th. By the afternoon of the 13th, an

Table 4.2.2d
Historic Northeaster and Winter Storm Events – City of Fredericksburg

Date	Event	Rain Fall (in.)	Comments
			upper level disturbance brought warm air into the mid levels of the atmosphere and caused snow that fell from the system to melt to rain on its way down. When the rain hit the ground where temperatures were below freezing, ice accumulated.
February 22, 2001	Winter Storm	0	▪ This system produced mainly light to moderate snowfall across the region between 9 AM and 10 PM. Snowfall amounts ranged from 2 to 5 inches. A 50 vehicle crash occurred on the northbound lanes near Masaponax in Spotsylvania County. The accident occurred as motorists crested the top of a hill, hit near zero visibility, and slammed on their breaks. Three people were treated for serious injuries and another 18 suffered minor injuries. The highway remained closed for three hours while the wreckage was cleared. A 30 vehicle pileup occurred on the southbound lanes just north of the Falmouth/Route 17 interchange in Stafford County. As whiteout conditions struck, three cars slid into each other. Within seconds, the minor fender bender turned into a pileup including tractor trailers, cars, trucks, and an empty bus. Three people were injured and the highway was blocked for nearly three hours.
January 3, 2002	Winter Storm	0	▪ Low pressure tracked across extreme southeast Virginia during the morning of the 3rd. This storm brought light to moderate snowfall to the Central Piedmont and Fredericksburg areas between 5 AM and 3 PM. In Stafford County, an inch of snow caused slippery roads and delayed school openings. In Spotsylvania and King George Counties, snowfall totals ranged from 3 to 5 inches.
January 19, 2002	Winter Weather	0	▪ Low pressure that moved across North Carolina on the 19th brought mixed precipitation to the region between 6 AM and 11 PM. In most locations, the precipitation started off in the form of snow, then changed to a mix of sleet and rain around midday.
December 5, 2002	Winter Storm	0	▪ This storm produced accumulating snowfall across the entire region as it moved by. Across the Central Piedmont and Fredericksburg area, freezing rain and sleet was mixed in with the snow. The snow and sleet accumulations ranged from 4 to 6 inches in this area.
February 6, 2003	Winter Storm	0	▪ Low pressure tracked from the Gulf Coast to the Carolinas on the 6th then off the Atlantic coast on the 7th. This storm dropped light to moderate snow between the evening of the 6th and Noon on the 7th. Accumulations ranged from 3 to 7 inches.
February 14, 2003	Winter Storm	8.9M	▪ A complex storm system produced copious amounts of wintery precipitation across the northern third of Virginia between the evening of the 14th and midday on the 18th. After the precipitation came to an end, record breaking snow and sleet accumulations were reported.
February 26, 2003	Winter Weather/mix	0	▪ A series of low pressure systems that tracked from the Gulf Coast to Cape Hatteras dropped light snow off and on between the morning of the 26th and midday on the 28th. A total of 5 to 8 inches of snow accumulated across the northern third of Virginia during the storm. Minor traffic accidents were reported after the fallen snow made roads slippery.
December 14, 2003	Winter Weather/mix	0	▪ An area of low pressure developed over the Gulf Coast region and tracked northeast into the Mid Atlantic region. The storm produced a mixture of snow, sleet and freezing rain. Snowfall totals

Table 4.2.2d
Historic Northeaster and Winter Storm Events – City of Fredericksburg

Date	Event	Rain Fall (in.)	Comments
			across Northeast Virginia averaged 3 to 4 inches.
January 25, 2004	Winter Weather/mix	0	▪ An area of low pressure developed off the coast of North Carolina and tracked north. This storm produced widespread snow, sleet and freezing drizzle over the region. Two to four inches of snow fell over the Central Foothills and the Northern Piedmont of Virginia. The snow mixed with sleet and finally changed over to freezing drizzle before tapering off. Several other minor accidents occurred according to Emergency Operations Centers. Dozens of school districts closed.

Source: National Climatic Data Center, 2005.

Table 4.2.2e
Historic Drought Events – City of Fredericksburg

Date	Crop Damage ($)	Descriptions
August 7, 1995	0	Dry weather, combined with periods of excessive heat, caused some damage to several crops, and limited the production of healthy livestock, during a month-long period that extended through mid-September. August, normally one of the wettest months, was the sixth-driest on record at Washington/National Airport (Arlington County), with barely seven-eighths of an inch (normal: 3.91 inches). Across the region, monthly precipitation averaged one to two inches, with virtually all of it falling before August 7th. The drought continued into mid-September, when it was alleviated somewhat by steady rains late on the 16th and early on the 17th. However, mean temperatures were much lower in September, ironically due to drier air masses, which allowed temperatures to plummet into the 50s on several mornings. Nonetheless, Washington/National broke an all-time record for consecutive days without measurable precipitation, with 33.
August 1, 1998	0	Persistent high pressure brought unusually dry weather during the entire month for much of northern and central Virginia. Only 0.45 inches of rain fell at Washington Dulles Airport, which was significantly less than the normal of 3.94 inches. Similar readings were found across most of central and northern Virginia. The lack of rainfall substantially reduced crop yields. The lack of rainfall also contributed to increasingly dry timber and brush. The U.S. Forest Service reported the George Washington and Jefferson National Forests were twice as dry as normal, and five fires broke out in these parks during the first week of the month. A water emergency was declared in Spotsylvania Co (VAZ056) on the 30th as the Ni River reservoir had neared dangerously low levels.
November 1, 1998	0	This was the fifth month in a row that drought conditions were seen across Northern Virginia. Persistent high pressure over the Southeast U.S. forced rain producing low pressure systems to steer north of the region. Only 0.91 inches of rain fell at Reagan National Airport in Arlington County during the month of November, 2.19 inches below normal. The 5 month total at the airport was only 5.78 inches, 11.38 inches below normal. The independent city of Fredericksburg received only 1.0 inches. By the end of the month, the Ni Reservoir, main water supply in Spotsylvania County, had only backup reserve water left and was at a record low level. The county was forced to continue mandatory water restrictions and buy additional water from Stafford County. The agricultural community continued to suffer through the second worst drought in the past 100 years. This was the first year the Farm Service Agency had to make direct payments for grazing losses. The drought has also contributed to a nearly unprecedented amount of forest and brush fires. Sixty-five fires were reported across Virginia between November 1st and 20th. Stafford County reported several significant brush fires during the month, and dozens of smaller fires burned in several other locations.
December 1, 1998	0	This was the sixth month in a row that drought conditions were seen across Northern Virginia. Only 1.74 inches of precipitation fell at Washington Reagan National Airport in Arlington County during December, 1.38 inches below normal. In the past 127 years, only one other July through December on record (1930) received less precipitation than the last half of 1998. The 6 month total at the airport was only 7.45 inches, 12.82 inches below normal. The Ni Reservoir, main water supply in Spotsylvania County, remained at a record low level through the month. Mandatory water restrictions continued across the county for the fifth straight month, and on the 8th, county businesses were banned from using water outdoors. The Palmer Index rated Northern Virginia in a severe to extreme drought, and the Governor declared a state of emergency across Virginia on December 1st due to the dry weather and resulting extreme fire danger. An open burning ban continued across Virginia through December 10th.

Table 4.2.2e
Historic Drought Events – City of Fredericksburg

Date	Crop Damage ($)	Descriptions
May 1, 1999	0	High pressure was the dominant weather feature across Northern Virginia during the month. Conditions on the Shenandoah and Rappahannock River were also extremely dry. Some stations in these two watersheds reported streamflow at or below the 90th percentile exceedence, which rivaled minimum daily mean flow values of the drought of 1980-82. With such low water tables, Spotsylvania County was forced to reinstate voluntary water restrictions. The Ni River Reservoir, main water source for the county, had already dipped 4 inches below the spillway by mid month. The lack of precipitation also played havoc with spring planting and livestock maintenance. Trees were prematurely shedding leaves in orchards, hay and pastureland were wilting, and watering holes and irrigation sources were slowly drying up.
June 1, 1999	0	High pressure was the dominant weather feature across Northern Virginia during the month. This weather pattern directed rain producing low pressure systems north of the region and continued the climatological drought that has gripped the area since last summer. By the last week of June, the Palmer Drought Index, a measure of long term drought conditions, indicated Northern Virginia was in a severe drought. Flows in the Potomac, Shenandoah, and Rappahannock basins, were equal to or slightly below minimum June daily mean flow values recorded during the 1980-82 drought. Many gaging stations reported streamflow at or below the 90 percent exceedence, and a few reported streamflow values at or below the 95th percentile. Streamflow of the Rappahannock River at Fredericksburg was only 14% of normal. With such low water tables, the city of Fredericksburg was forced to start voluntary water restrictions. The Ni River Reservoir, main water source for Spotsylvania County, dipped 16 inches below full by mid month.
July 1, 1999	83.0M	High pressure was the dominant weather feature across Northern Virginia during the month. This forced most rain producing storm systems to steer north of the region and resulted in the continuation of the climatological, meteorological, and hydrological drought that had plagued the area since last summer. Many stations on the Shenandoah and Rappahannock watersheds reported streamflow at or below the 90 percent exceedence, which rivaled minimum daily mean flow values of the drought of 1980-82. The Rappahannock River was approaching 10% of normal flow, and west of Fredericksburg was flowing with just a few feet of water. Twenty miles upstream of Fredericksburg, the river was too shallow for canoes. The Ni River Reservoir, main water source for Spotsylvania County, dipped 4 inches below the spillway by mid month. In addition to agricultural lands, forest and rural vegetation were also dangerously dry. The Virginia Department of Forestry reported a record fire season January through July, 1320 fires burning 6146 acres. This number already exceeded the amount of fires reported in 1998. During the month of July alone, 61 fires burned 280 acres. The Cumulative Severity Index, a measure of fire danger which ranges from 1 to 800, gave Northern Virginia a rating of 628 by month's end. Animal control officials also attributed an increase of wildlife entering populated areas in search of food and water to the drought.
August 1, 1999	41.7M	High pressure was the dominant weather feature across Northern Virginia through the 24th of August. Most rain producing storm systems steered north of the region through the period. This resulted in the continuation of the climatological, meteorological, and hydrological drought which has plagued the area since last summer. Heavy rain fell east of the Blue Ridge Mountains on the 25th and 27th, helping to fill surface reservoirs. Unfortunately, because most of the rain fell in the form of thunderstorm downpours, most of the moisture ran off into rivers before it had the chance to seep into the aquifer supply.

Table 4.2.2e
Historic Drought Events – City of Fredericksburg

Date	Crop Damage ($)	Descriptions
September 1, 1999	5.0M	Rainfall from two land falling hurricanes made a tremendous impact on the drought that plagued the region since the summer of 1998. Across Northern Virginia, the greatest amount of rain fell north of a line from Staunton to Fredericksburg. The water shortage came to an end in this area by mid month. Locations to the south recorded a major increase in water supplies, upgrading their condition from an extreme drought to a mild drought, but not enough rain fell to completely wipe out the shortage. The Ni River Reservoir returned to 71% of its capacity by the end of the month, allowing officials in Spotsylvania County to lift mandatory water restrictions that were in effect for 13 months.

Source: National Climatic Data Center, 2005

Table 4.2.2f
Historic Hurricane Events – City of Fredericksburg

Storm Name	Date	Category	Total Est. Damage	Descriptions
Hazel	October 15, 1954	Hurricane	Unknown	▪ The Free-Lance Star reported flooding and property damage.
Connie	August 12, 1955	Hurricane	Unknown	▪ The Free-Lance Star reported flooding and property damage.
Diane	August 17, 1955	Hurricane	Unknown	▪ The Free-Lance Star reported flooding and property damage.
Camille	September 1960	Hurricane	Unknown	▪ The Free-Lance Star reported massive flooding.
Floyd	September 16, 1999	Tropical Storm	No estimate available.	▪ Gusty winds from 30 to 50 mph ▪ 2 to 5 inches of rain ▪ 16,000 power outages
Isabel	September 18, 2003	Tropical Storm	$55.1 million – property $130,000 – crop	▪ Highest sustained wind was73 mph ▪ Uprooted thousands of trees and downed numerous power lines ▪ Over 2 million Virginians without power
Charley And Bonnie	August 18, 2004	Hurricane	Unknown	▪ Highest sustained wind was 73 mph ▪ Uprooted trees and downed numerous power lines ▪ Over 2 million Virginians without power ▪ Heavy rain and wind gust
Frances	September 8, 2004	Hurricane	Unknown	▪ Generated 9 tornadoes in Central Virginia ▪ High winds ▪ Large amounts of rainfall/flooding
Ivan	September 17, 2004	Hurricane	Unknown	▪ Spawned unconfirmed tornadoes ▪ Power outage (66,000) ▪ Heavy rain/flooding
Jeanne	September 28, 2004	Hurricane	Unknown	▪ Flash flooding/heavy rainfall ▪ Power outage
Gaston	August 30, 2004	Tropical Depression	Unknown	▪ Hard rains that processed flooding ▪ Roads under water ▪ Power outage (99,600 statewide)

Source: NOAA 2004, VWC 2004, and local emergency management.

Table 4.2.2g
Historic Tornado Events – City of Fredericksburg

Date	Magnitude	Property Damage ($)	Descriptions
July 24, 1999	F1	20K	▪ Spotsylvania County tornado crossed over the City of Fredericksburg Warm and humid air ahead of a cold front combined to produce scattered thunderstorms across the northern half of Virginia from midday through sunset. ▪ The first batch of thunderstorms developed over Rockingham County around 12:30 PM EDT and moved eastward to the Potomac River by 3:00 PM EDT. These storms produced winds in excess of 55 MPH, large hail, frequent lightning, and a tornado that crossed parts of Orange, Spotsylvania, and Stafford County. ▪ A tornado developed near Lake of the Woods in Orange County. It stayed on the ground for 20 miles and moved across northern Spotsylvania County, the city of Fredericksburg, and the northwest portion of Stafford County. The tornado was of F1 strength for most of its path, occasionally weakening to F0 strength in some locations. ▪ Next, the storm passed directly over the southern half of the city of Fredericksburg, downing several more trees and power lines, blocking roads and knocking power out for 12,000 customers. Nine buildings in the city were significantly damaged.
May 7, 2004	F1	10K	▪ At 7:51 p.m., an F1 tornado touched down near Shiloh. At least a dozen dwellings and 10 boats were damaged. Several trees were also uprooted or had their tops ripped out along the storm's three-mile path. In Stafford County, 80 to 90 mph winds destroyed two homes and caused major damage to 20 others. The Japazawas Subdivision in eastern Stafford County had approximately 40 trees down. Three Amtrak trains were stalled between the Chatham area of Stafford and Fredericksburg due to downed trees and power lines. In Spotsylvania County, the main stage at the re-enactment of the Battle of Spotsylvania collapsed due to strong winds. A number of tents and a couple of portable toilets were also blown over. Estimated damages were $10,000.
September 17, 2004	F1	0K	▪ A thunderstorm moved from Spotsylvania County into the eastern portion of the City of Fredericksburg. No property damage was reported, with debris scattered along Dixon Street.

Source: National Climatic Data Center, 2005; NOAA 2004 and VDEM

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4.2.3 King George County Hazard Identification

The HMPC representatives for King George County performed a two-stage evaluation of identified natural hazards affecting the RADCO region. First, the hazards were grouped into two categories; critical and non-critical hazards. Secondly, in conjunction with the consulting team, each critical hazard was ranked based on the threat posed to its citizens (Table 4.2.3a). Hazards that ranked critical with a medium to high hazard level were then investigated further and a vulnerability analysis was performed.

Table 4.2.3a Prioritization of Natural Hazards
King George County

Hazard type	Critical vs. Non-Critical	Probability of Occurrence
Northeasters Winter Storms	Critical	High
Wildfire	Critical	High
Drought	Critical	Medium
Hurricanes	Critical	Medium
Tornadoes	Critical	Medium
Biological Hazards	Critical	Low
Dam Failure	Critical	Low
Thunderstorms	Non-Critical	High
Extreme Heat	Non-Critical	Medium
Flooding	Non-Critical	Medium
Earthquakes	Non-Critical	Low
Expansive Soils	Non-Critical	Low
Landslides	Non-Critical	Low

Northeasters and Winter Storms

In evaluating the localized threat of winter storms to King George County, the HMPC analyzed local NOAA severe weather data from 1950 to 2005 to identify storms that may have posed a threat to the community. These past occurrences are presented in Table 4.2.3b. Locally, the 24 northeasters and winterstorms have caused:

- Excessive snow, sleet, and freezing rain;
- Multiple traffic accidents and delays;
- Tree and property damage;
- Power outages; and
- Injury and loss of life.

A noted winter event in January 2000 cause power outages to over 3,000 customers in King George County, the City of Fredericksburg; and Spotsylvania County.

The probability of future occurrences is ranked as medium. With 24 events occurring between 1993 and 2004, King George County experiences approximately 2.8 winter events per year.

Wildfire

In evaluating the localized threat of wildfires to King George County, the HMPC analyzed data documented by the local Office of Emergency Management (Table 4.2.3c) and the Virginia Department of Forestry (Table 4.2.3d). The data from the Department of Forestry included wildfires that occurred between the years 1995-2001 with a total number of acres burned, forest or non-forest, greater than one acre. Fires occurring on federal lands were not included.

The seven wildfires that occurred prior to 1995 burned more than 3600 acres. The 12 wildfires that have occurred since 1995 have burned only 45 acres. The wildfires have caused:

- Destruction of multiple acres of land;
- Destruction of buildings and homes; and
- Destruction of petroleum tanks.

Based on information from 1995-2001, King George County averages two wildfires per year. Therefore, the probability of future occurrences is ranked as high.

Drought

According to the National Climatic Data Center, there have been fourteen drought events reported in RADCO region between January 1, 1950 and July 30, 2005. These past occurrences are presented in Table 4.2.3e. Locally, droughts have caused:

- Requests to the Governor for disaster status;
- Voluntary and mandatory reductions in water usage;
- Reduction in crop yields:
- Grazing losses;
- Increase in forest and brush fires; and
- Reduction in streamflow and water table.

The probability of future occurrences is ranked as medium. According to the National Weather Service, Climate Prediction Center, drought development in the RADCO region, including King George County, is likely through December 2005.

Hurricanes

In evaluating the localized threat of hurricanes to King George County, the HMPC analyzed NOAA hurricane track data from 1851 to 2004 to identify storms that may have posed a threat to the community. The analysis included hurricanes, tropical storms, tropical depressions, and extratropical storms which passed through the region and affected the local community. These past occurrences are presented in Table 4.2.3f. Locally, the eleven (11) hurricanes have caused:

- Heavy rain;
- Gusty and high sustained winds;
- Flooding and property damage; and
- Multiple power outages.

Hurricane Isabel, occurring in 2003, resulted in trees down over every road in the County. Debris removal was the initial problem in getting roads open for use. Several roads took three to four days to clear. There was low to moderate damage to hundreds of homes. Fortunately, no families were displaced, although approximately 200 citizens utilized the shelter during the storm. Ice and water were requested from the State. Power outages around the County lasted for up to 15 days.

Hurricane Frances, occurring in 2004, spawned at least two tornadoes which caused minor damage to five homes in the Berry Planes subdivision. Again in 2004, Hurricane Ivan spawned two tornadoes which caused moderate damage to 25 homes in the Lake Jefferson subdivision and surrounding areas of Igo Road and Little Chatterton Lane.

The probability of future occurrences is ranked as medium. With 11 hurricanes occurring between 1954 and 2004, the King George County experiences approximately 0.22 hurricanes per year.

Tornadoes

In evaluating the localized threat of tornadoes to King George County, the HMPC analyzed local emergency management data and NOAA severe weather data from 1950 to 2005 to identify storms that may have posed a threat to the community. Most tornado activity occurred from May to September, although a historic event in February was noted. These past occurrences are presented in Table 4.2.3g. Locally, the nine (9) tornadoes have caused:

- Property damage, including the destruction of boats;
- Tree damage and resultant power outages; and
- Loss of life.

Multiple tornadoes during the 2004 season caused damage throughout the County:

- A tornado in Waugh Point Area destroyed one house with three occupants inside, uprooted huge trees, twisted tops out of huge trees, and rolled 15 large boats off trailers at marina. Significant damage was noted to a second house.

- A tornado started at Port Conway near Montigue Baptist Church and continued to Shiloh area. There was moderate damage to the church, extensive tree damage, and debris from trees in roadways.

- Tornado came from Caroline County across the Rappahannock River moved through the Sealston area just missing the Sealston Elementary school. The tornado continued into Stafford County where there was extensive home damage in a subdivision. Debris from damaged trees caused minor cosmetic damage to some homes.
- A tornado came from Caroline County across Dogue to Rokeby and continued through Lake Jefferson subdivision and down to Little Chatterton Lane. There was moderate damage to 35 homes from falling trees. One home on Windy Hill was partially destroyed when the roof was lifted off and walls blown out of the garage. Debris from trees was moderate except for isolated roads in the Lake Jefferson subdivision, specifically Daws Drive and Igo Road.

The probability of future occurrences is ranked as medium. With 9 tornadoes occurring between 1960 and 2004, the King George County experiences approximately 0.21 tornadoes per year.

Table 4.2.3b
Historic Northeaster and Winter Storm Events – King George County

Date	Event	Property Damage ($)	Comments
December 28, 1993	Heavy Snow	0	
January 28, 1995	Heavy Snow	0	
January 9, 1996	Heavy Snow	0	▪ Low and mid-level lift ahead of an "Alberta Clipper" added insult to injury only a day after the "Blizzard of '96", dumping 4 inches of snow in a 5 hour period near the tidal Potomac River.
January 12, 1996	Heavy Snow	350K	▪ Less than one week after the crippling "Blizzard of '96", a new winter storm dumped substantial snow across northern and western Virginia. ▪ In southern Stafford Co (VAZ055), a woman was injured when a carport collapsed. The snow changed to freezing rain and sleet along the tidal Potomac River shortly before tapering off. The changeover suppressed accumulations to 4 or 5 inches in this region. In other portions of northern Virginia, snowfall totals were as follows: in the piedmont, 5 to 7 inches; at higher elevations, 6 to 10 inches. ▪ In southern Stafford Co (VAZ055), a woman was injured when a carport collapsed. Luckily, she was protected from serious injury by the automobile, which had its windows shattered.
February 2, 1996	Heavy Snow	0	▪ A vigorous upper level jet stream induced low-level lifting of warm moist air over a stationary arctic front extending from Tidewater Virginia through the Tennessee Valley early on the 2nd, producing a 75 mile-wide band of heavy snow which extended from the central piedmont through the Northern Neck region. ▪ The heaviest snows fell in a narrow band from northern Albemarle Co through King George Co. Accumulations in these areas ranged from 8 to 13 inches, and snowfall rates were as high as 3 inches per hour.
February 2, 1996	Heavy Snow	0	▪ The continuation of a strong upper-level jet stream, combined with additional mid-level dynamics, generated surface low pressure over central Georgia by evening on the 2nd. As the low moved to near Cape Hatteras overnight, a broad area of heavy snow overspread all of northern Virginia. Areas that received 4 to 13 inches during an early morning event (on the 2nd) picked up an additional 4 to 6 inches, leaving most areas from the central piedmont through the northern neck with a grand total of 12 to 18 inches.
February 16, 1996	Heavy Snow	0	▪ A strong "Alberta Clipper", diving southeast from the upper midwest into the deep south, linked up with subtropical moisture lurking along the southeast U.S. coast to develop a classic nor'easter, which moved from northeast South Carolina to off the Virginia Capes during the day on the 16th. As the area of low pressure intensified, it wrapped Atlantic moisture well to the west, where modified arctic air was pouring in from southern Canada. The result was a thin band of heavy snow which extended from southwest Virginia through the upper eastern shore of Maryland.
February 8, 1997	Heavy Snow	25K	▪ A winter storm dumped 4 to 8 inches of heavy, wet snow across all of northern and western Virginia on the 8th.

Table 4.2.3b
Historic Northeaster and Winter Storm Events – King George County

Date	Event	Property Damage ($)	Comments
January 14, 1999	Winter Weather	0	▪ A strong arctic cold front moved slowly southeast across the Mid-Atlantic region from late on the 13th to midday on the 15th. By 9am on the 15th, ice accumulations from one quarter to nearly one inch occurred north of a line from Augusta County to Spotsylvania County. The ice this storm left behind had a large impact on the region. Hundreds of car accidents, slip and fall injuries, downed trees, and power outages were reported. In Stafford County, a jackknifed tractor trailer closed State Route 3 and 621, and Interstate 95 had to be temporarily shut down to clear fallen trees. Over 215,000 customers lost power from the storm across Northern Virginia, and Central Virginia reported over 6,000 additional outages.
March 9, 1999	Winter Storm	0	▪ An area of low pressure moved from the Ohio Valley to North Carolina from late on the 8th through the evening of the 9th. Snowfall rates were in excess of 1 1/2 inches per hour in many locations during the storm. Stafford County received between 4 to 8 inches. Spotsylvania and King George County received between 2 and 6 inches. The city of Fredericksburg reported over 100 accidents. On Interstate 95 in Spotsylvania County, a woman was killed in a morning car accident.
January 20, 2000	Winter Weather	0	▪ An area of low pressure moved from west to east across the Mid-Atlantic region on the 20th, dropping 2 to 6 inches of snow between midnight and mid-afternoon. Gusty winds of 35 to 45 MPH developed during the afternoon causing the snow to drift across roadways and reduce visibilities in open areas.
January 25, 2000	Northeaster	0	▪ Low pressure off Cape Hatteras rapidly intensified late on the 24th and developed into a nor'easter which tracked northward along the Eastern Seaboard on the 25th. Very heavy snow and near-blizzard conditions were seen throughout the day east of the Blue Ridge Mountains, resulting in extremely hazardous travel conditions. Wind gusts of up to 45 MPH were recorded and several roads were drifted shut by blowing snow. The governor of Virginia declared a state of emergency as the storm battered the eastern part of the state.
January 30, 2000	Ice Storm	0	▪ Cold air was in place east of the Blue Ridge Mountains on the 29th and 30th, keeping surface temperatures below freezing. Low pressure moved from the Lower Mississippi Valley northeastward to the Mid-Atlantic region early on the 30th, creating the perfect conditions for freezing rain around the Fredericksburg area, a mix of sleet and snow east of Skyline Drive, and moderate snowfall in the mountains. Ice accumulations between 1/4 and 3/4 of an inch coated roads, trees, and power lines in Fredericksburg and Stafford, Spotsylvania, and King George Counties. Electrical outages were reported as trees and branches weighed down by ice fell onto power lines. Disruptions affected 3000 customers in Fredericksburg and Spotsylvania and King George Counties.

Table 4.2.3b
Historic Northeaster and Winter Storm Events – King George County

Date	Event	Property Damage ($)	Comments
February 12, 2000	Winter Weather	0	▪ Low pressure moved from Tennessee to the North Carolina Coast on the 12th, spreading snow across the Central Shenandoah Valley and the Northern and Central Piedmont. Periods of light snow occurred from sunrise to late afternoon with accumulations ranging from 1 to 5 inches. A period of freezing drizzle also occurred around sunset.
December 13, 2000	Winter Weather	0	▪ A strong cold front brought chilly air into the region on the 12th. By the afternoon of the 13th, an upper level disturbance brought warm air into the mid levels of the atmosphere and caused snow that fell from the system to melt to rain on its way down. When the rain hit the ground where temperatures were below freezing, ice accumulated.
February 22, 2001	Winter Storm	0	▪ This system produced mainly light to moderate snowfall across the region between 9 AM and 10 PM. Snowfall amounts ranged from 2 to 5 inches. A 50 vehicle crash occurred on the northbound lanes near Masaponax in Spotsylvania County. The accident occurred as motorists crested the top of a hill, hit near zero visibility, and slammed on their breaks. Three people were treated for serious injuries and another 18 suffered minor injuries. The highway remained closed for three hours while the wreckage was cleared. A 30 vehicle pileup occurred on the southbound lanes just north of the Falmouth/Route 17 interchange in Stafford County. As whiteout conditions struck, three cars slid into each other. Within seconds, the minor fender bender turned into a pileup including tractor trailers, cars, trucks, and an empty bus. Three people were injured and the highway was blocked for nearly three hours.
January 3, 2002	Winter Storm	0	▪ Low pressure tracked across extreme southeast Virginia during the morning of the 3rd. This storm brought light to moderate snowfall to the Central Piedmont and Fredericksburg areas between 5 AM and 3 PM. In Stafford County, an inch of snow caused slippery roads and delayed school openings. In Spotsylvania and King George Counties, snowfall totals ranged from 3 to 5 inches.
January 19, 2002	Winter Weather	0	▪ Low pressure that moved across North Carolina on the 19th brought mixed precipitation to the region between 6 AM and 11 PM. In most locations, the precipitation started off in the form of snow, then changed to a mix of sleet and rain around midday.
December 5, 2002	Winter Storm	0	▪ This storm produced accumulating snowfall across the entire region as it moved by. Across the Central Piedmont and Fredericksburg area, freezing rain and sleet was mixed in with the snow. The snow and sleet accumulations ranged from 4 to 6 inches in this area.
February 6, 2003	Winter Storm	0	▪ Low pressure tracked from the Gulf Coast to the Carolinas on the 6th then off the Atlantic coast on the 7th. This storm dropped light to moderate snow between the evening of the 6th and Noon on the 7th. Accumulations ranged from 3 to 7 inches.
February 14, 2003	Winter Storm	8.9M	▪ A complex storm system produced copious amounts of wintery precipitation across the northern third of Virginia between the evening of the 14th and midday on the 18th. After the precipitation came to an end, record breaking snow and sleet accumulations were reported.
February 26, 2003	Winter Weather/mix	0	▪ A series of low pressure systems that tracked from the Gulf Coast to Cape Hatteras dropped light snow off and on between the morning of the 26th and midday on the 28th. A total of 5 to 8 inches

Table 4.2.3b
Historic Northeaster and Winter Storm Events – King George County

Date	Event	Property Damage ($)	Comments
			of snow accumulated across the northern third of Virginia during the storm. Minor traffic accidents were reported after the fallen snow made roads slippery.
December 14, 2003	Winter Weather/mix	0	▪ An area of low pressure developed over the Gulf Coast region and tracked northeast into the Mid Atlantic region. The storm produced a mixture of snow, sleet and freezing rain. Snowfall totals across Northeast Virginia averaged 3 to 4 inches.
January 25, 2004	Winter Weather/mix	0	▪ An area of low pressure developed off the coast of North Carolina and tracked north. This storm produced widespread snow, sleet and freezing drizzle over the region. Two to four inches of snow fell over the Central Foothills and the Northern Piedmont of Virginia. The snow mixed with sleet and finally changed over to freezing drizzle before tapering off. Several other minor accidents occurred according to Emergency Operations Centers. Dozens of school districts closed.

Source: National Climatic Data Center, 2005.

Table 4.2.3c
Wildfire History (prior to 1995) – King George County

Date	Location	Descriptions
March 14, 1963	Dogue	▪ The King George News reported 79 acres of woodlands burned. One out building destroyed.
April 20, 1963	Route 301 & 205 and East towards Westmoreland	▪ As reported in the Free-Lance Star / Richmond Times-Dispatch / King George News, 3500 acres of woodland burned and two to four homes in King George County. Started by a Burn Barrel.
January 11, 1966	2.5 miles east of King George Courthouse	▪ The Free-Lance Star reported 36,000 gallons of fuel (Kerosene, Gasoline, and heating oil) burned destroying 4 of 5 tanks at the Southern States Petroleum Service Station. Several acres of woodlands also burned. Ashland Mill Road by Canterbury.
August 22, 1966	1.5 miles west of King George Courthouse	▪ The Free-Lance Star reported saw mill and grounds destroyed by fire. Where current Post Office is on Rt. 3
Easter 1968	County Wide	▪ Seven fires totaling 22 acres and one home destroyed
July 23, 1969	County Wide	▪ The King George News reported an electrical storm came through King George causing structural fires.
July 12, 1986	NA	▪ 10 acres lost in field fire

Source: Local emergency management; NA = Data not available.

Table 4.2.3d
VDOF Historic Wildfire Events – King George County

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
03/17/1995	1	0	8000	Miscellaneous
08/25/1995	1	0	0	Debris Burning
06/26/1997	1	0	0	Miscellaneous
03/27/1998	1	0	0	Debris Burning
03/30/1998	14	500	0	Incendiary
09/06/1998	3	0	60000	Smoking
05/07/1999	1	0	0	Children
08/24/1999	2	0	0	Smoking
11/17/1999	1	0	0	Debris Burning
01/28/2001	18	0	0	Miscellaneous
02/20/2001	0	0	5000	Miscellaneous
03/19/2001	2	0	0	Smoking
Totals	**45**	**$500**	**$73,000**	

Source: Virginia Department of Forestry, 2005.

Table 4.2.3e
Historic Drought Events – King George County

Date	Crop Damage ($)	Descriptions
August 14, 1980	0	Via resolution, King County Board of Supervisors requested that the Governor of Virginia declare King George County a disaster area due to drought.
September 1, 1983	0	Via resolution, King County Board of Supervisors requested that the Governor of Virginia declare King George County a disaster area due to drought.
September 15, 1988	0	Via resolution, King County Board of Supervisors requested that the Governor of Virginia declare King George County a disaster area due to drought.
August 7, 1995	0	Dry weather, combined with periods of excessive heat, caused some damage to several crops, and limited the production of healthy livestock, during a month-long period that extended through mid-September. August, normally one of the wettest months, was the sixth-driest on record at Washington/National Airport (Arlington County), with barely seven-eighths of an inch (normal: 3.91 inches). Across the region, monthly precipitation averaged one to two inches, with virtually all of it falling before August 7th. The drought continued into mid-September, when it was alleviated somewhat by steady rains late on the 16th and early on the 17th. However, mean temperatures were much lower in September, ironically due to drier air masses, which allowed temperatures to plummet into the 50s on several mornings. Nonetheless, Washington/National broke an all-time record for consecutive days without measurable precipitation, with 33.
February 18, 1997	0	Via resolution, King County Board of Supervisors requested that the Governor of Virginia declare King George County a disaster area due to drought.
August 1, 1998	0	Persistent high pressure brought unusually dry weather during the entire month for much of northern and central Virginia. Only 0.45 inches of rain fell at Washington Dulles Airport, which was significantly less than the normal of 3.94 inches. Similar readings were found across most of central and northern Virginia. The lack of rainfall substantially reduced crop yields. The lack of rainfall also contributed to increasingly dry timber and brush. The U.S. Forest Service reported the George Washington and Jefferson National Forests were twice as dry as normal, and five fires broke out in these parks during the first week of the month. A water emergency was declared in Spotsylvania Co (VAZ056) on the 30th as the Ni River reservoir had neared dangerously low levels.
November 1, 1998	0	This was the fifth month in a row that drought conditions were seen across Northern Virginia. Persistent high pressure over the Southeast U.S. forced rain producing low pressure systems to steer north of the region. Only 0.91 inches of rain fell at Reagan National Airport in Arlington County during the month of November, 2.19 inches below normal. The 5 month total at the airport was only 5.78 inches, 11.38 inches below normal. The independent cities of Fredericksburg received only 1.0 inches. By the end of the month, the Ni Reservoir, main water supply in Spotsylvania County, had only backup reserve water left and was at a record low level. The county was forced to continue mandatory water restrictions and buy additional water from Stafford County. The agricultural community continued to suffer through the second worst drought in the past 100 years. This was the first year the Farm Service Agency had to make direct payments for grazing losses. The drought has also contributed to a nearly unprecedented amount of forest and brush fires. Sixty-five fires were reported across Virginia between November 1st and 20th. Stafford County reported several significant brush fires during the month, and dozens of smaller fires burned in several other locations.

Table 4.2.3e
Historic Drought Events – King George County

Date	Crop Damage ($)	Descriptions
December 1, 1998	0	This was the sixth month in a row that drought conditions were seen across Northern Virginia. Only 1.74 inches of precipitation fell at Washington Reagan National Airport in Arlington County during December, 1.38 inches below normal. In the past 127 years, only one other July through December on record (1930) received less precipitation than the last half of 1998. The 6 month total at the airport was only 7.45 inches, 12.82 inches below normal. The Ni Reservoir, main water supply in Spotsylvania County, remained at a record low level through the month. Mandatory water restrictions continued across the county for the fifth straight month, and on the 8th, county businesses were banned from using water outdoors. The Palmer Index rated Northern Virginia in a severe to extreme drought, and the Governor declared a state of emergency across Virginia on December 1st due to the dry weather and resulting extreme fire danger. An open burning ban continued across Virginia through December 10th.
May 1, 1999	0	High pressure was the dominant weather feature across Northern Virginia during the month. Conditions on the Shenandoah and Rappahannock River were also extremely dry. Some stations in these two watersheds reported streamflow at or below the 90th percentile exceedence, which rivaled minimum daily mean flow values of the drought of 1980-82. With such low water tables, Spotsylvania County was forced to reinstate voluntary water restrictions. The Ni River Reservoir, main water source for the county, had already dipped 4 inches below the spillway by mid month. The lack of precipitation also played havoc with spring planting and livestock maintenance. Trees were prematurely shedding leaves in orchards, hay and pastureland were wilting, and watering holes and irrigation sources were slowly drying up.
June 1, 1999	0	High pressure was the dominant weather feature across Northern Virginia during the month. This weather pattern directed rain producing low pressure systems north of the region and continued the climatological drought that has gripped the area since last summer. By the last week of June, the Palmer Drought Index, a measure of long term drought conditions, indicated Northern Virginia was in a severe drought. Flows in the Potomac, Shenandoah, and Rappahannock basins, were equal to or slightly below minimum June daily mean flow values recorded during the 1980-82 drought. Many gaging stations reported streamflow at or below the 90 percent exceedence, and a few reported streamflow values at or below the 95th percentile. Streamflow of the Rappahannock River at Fredericksburg was only 14% of normal. With such low water tables, the city of Fredericksburg was forced to start voluntary water restrictions. The Ni River Reservoir, main water source for Spotsylvania County, dipped 16 inches below full by mid month.
July 1, 1999	83.0M	High pressure was the dominant weather feature across Northern Virginia during the month. This forced most rain producing storm systems to steer north of the region and resulted in the continuation of the climatological, meteorological, and hydrological drought that had plagued the area since last summer. Many stations on the Shenandoah and Rappahannock watersheds reported streamflow at or below the 90 percent exceedence, which rivaled minimum daily mean flow values of the drought of 1980-82. The Rappahannock River was approaching 10% of normal flow, and west of Fredericksburg was flowing with just a few feet of water. Twenty miles upstream of Fredericksburg, the river was too shallow for canoes. The Ni River Reservoir, main water source for Spotsylvania County, dipped 4 inches below the spillway by mid month. In addition to agricultural lands, forest and rural vegetation were also dangerously dry. The Virginia Department of Forestry reported a record fire season January through July, 1320 fires burning 6146 acres. This number already exceeded the amount of fires reported in 1998. During the month of July alone, 61 fires burned 280 acres. The Cumulative Severity Index, a measure of fire danger which ranges from 1 to 800, gave Northern Virginia a rating of 628 by month's end. Animal control officials also attributed an increase of wildlife entering populated areas in search of food and water to the drought.

Table 4.2.3e
Historic Drought Events – King George County

Date	Crop Damage ($)	Descriptions
August 1, 1999	41.7M	High pressure was the dominant weather feature across Northern Virginia through the 24th of August. Most rain producing storm systems steered north of the region through the period. This resulted in the continuation of the climatological, meteorological, and hydrological drought which has plagued the area since last summer. Heavy rain fell east of the Blue Ridge Mountains on the 25th and 27th, helping to fill surface reservoirs. Unfortunately, because most of the rain fell in the form of thunderstorm downpours, most of the moisture ran off into rivers before it had the chance to seep into the aquifer supply. Via resolution, on August 17, 1999, the King County Board of Supervisors requested that the Governor of Virginia declare King George County a disaster area due to drought.
September 1, 1999	5.0M	Rainfall from two land falling hurricanes made a tremendous impact on the drought that plagued the region since the summer of 1998. Across Northern Virginia, the greatest amount of rain fell north of a line from Staunton to Fredericksburg. The water shortage came to an end in this area by mid month. Locations to the south recorded a major increase in water supplies, upgrading their condition from an extreme drought to a mild drought, but not enough rain fell to completely wipe out the shortage. The Ni River Reservoir returned to 71% of its capacity by the end of the month, allowing officials in Spotsylvania County to lift mandatory water restrictions that were in effect for 13 months.
August 6, 2002	0	Via resolution, King County Board of Supervisors requested that the Governor of Virginia declare King George County a disaster area due to drought.

Source: National Climatic Data Center, 2005; and local emergency management.

Table 4.2.3f
Historic Hurricane Events – King George County

Storm Name	Date	Category	Total Est. Damage	Descriptions
Hazel	October 15, 1954	Hurricane	Unknown	▪ The Free-Lance Star reported flooding and property damage.
Connie	August 12, 1955	Hurricane	Unknown	▪ The Free-Lance Star reported flooding and property damage.
Diane	August 17, 1955	Hurricane	Unknown	▪ The Free-Lance Star reported flooding and property damage.
Camille	September 1960	Hurricane	Unknown	▪ The Free-Lance Star reported massive flooding.
Floyd	September 16, 1999	Tropical Storm	No estimate available.	▪ Gusty winds from 30 to 50 mph ▪ 2 to 5 inches of rain ▪ 16,000 power outages
Isabel	September 18, 2003	Tropical Storm	Unknown	▪ Trees down over every road in County. High winds to 85 mph sustained with gusts to 101mph. Over 300 emergency calls, low to moderate damage to 100's of homes, no families displaced, almost 200 in shelter during storm, ice and water request from State, power outages Countywide for up to 15 days. Isolated power outages longer. EOC operational for 5 days. Shelter open one night. Debris removal initially a problem getting roads open. Some roads took 3-4 days to clear. VDOT debris removal continued for one month. ▪ Major damage to infrastructure County wide. Federal Declaration received. FEMA arrived and individual assistance provided. Major damage to many homes, some not inhabitable. Shelter opened with 85 people sheltered during storm. At least one crab business reportedly flooded.
Charley And Bonnie	August 18, 2004	Hurricane	Unknown	▪ Highest sustained wind was 73 mph ▪ Uprooted trees and downed numerous power lines ▪ Over 2 million Virginians without power ▪ Heavy rain and wind gust ▪ 2-4 inches of rain, mild winds, indirect hit to area. No damage noted
Frances	September 8, 2004	Hurricane	Unknown	▪ At least two tornadoes touched down causing minor damage to 5 homes in the Berry Planes subdivision. Other areas affected were woods only. No Presidential Declaration received. Moderate wind gusts and rains. Indirect hit – hurricane.
Ivan	September 17, 2004	Hurricane	Unknown	▪ At least two tornadoes touched down causing moderate damage to 25 homes in the Lake Jefferson subdivision and surrounding areas of Igo Road and Little Chatterton Lane. Other areas affected were woods only. No Presidential Declaration received. Moderate wind gusts and rains. Indirect hit - hurricane.
Jeanne	September 28, 2004	Hurricane	Unknown	▪ 2-4 inches of rain and moderate winds across the County. No damage reported. Tornado Watch in affect – none received. Indirect hit.
Gaston	August 30, 2004	Tropical Depression	Unknown	▪ Hard rains that processed flooding ▪ Roads under water ▪ Power outage (99,600 statewide) ▪ 2-4 inches of rain, mild winds, indirect hit to area. No damage noted

Source: NOAA 2004, VWC 2004, local emergency management, *The Free Lance and Daily Star.*

Table 4.2.3g
Tornado History – King George County

Date	Magnitude	Property Damage ($)	Descriptions
February 18, 1960	F1	0K	
September 5, 1979	F1	250K	
Late 1990's	NA	NA	▪ NSWCDD to Ferry Dock Road in Dahlgren ▪ Tornado came through naval base twisting off enormous trees with minor damage to some homes mostly from falling trees. Continued through Ferry Dock Road and across Potomac Drive with tree damage.
July 2, 1999	F1	10K	▪ Parts of southern King George County lost power after downed trees fell onto power lines.
July 10, 2003	F0	0	▪ F0 tornado touched down approximately 5 miles southeast of Falmouth near Route 3 ▪ The tornado moved northeast and damaged trees until it lifted near Route 218 on the King George County line
May 7, 2004	F1	10K	▪ At 7:51 p.m., an F1 tornado touched down near Passapatanzy. At least a dozen dwellings and 10 boats were damaged. Several trees were also uprooted or had their tops ripped out along the storm's three-mile path. In Stafford County, 80 to 90 mph winds destroyed two homes and caused major damage to 20 others. The Japazawas Subdivision in eastern Stafford County had approximately 40 trees down. Three Amtrak trains were stalled between the Chatham area of Stafford and Fredericksburg due to downed trees and power lines. In Spotsylvania County, the main stage at the re-enactment of the Battle of Spotsylvania collapsed due to strong winds. A number of tents and a couple of portable toilets were also blown over. Estimated damages were $10,000.
Fall 2004	NA	NA	▪ 4 Tornadoes spawned from multiple back to back hurricanes ▪ Tornado in Waugh Point Area destroyed one house with three occupants inside, uprooted huge trees, twisted tops out of huge trees, rolled 15 large boats off trailers at marina. Significant damage to a second house. ▪ Tornado started at Port Conway near Montigue Baptist Church and continued to Shiloh area. Moderate damage to church, extensive tree damage, Debris from trees in roadways. ▪ Tornado came from Caroline County across the Rappahannock river moved through Sealston area just missing Sealston Elementary school. Continued into Stafford County where there was extensive home damage in a subdivision. Debris from damaged trees minor cosmetic damage to some homes. ▪ Tornado came from Caroline County across Dogue to Rokeby and continued through Lake Jefferson subdivision and down to Little Chatterton Lane. 35 homes with moderate damage from falling trees, one home on windy hill partially destroyed when roof was lifted off and walls blown out of garage. Two barns destroyed by wind, Little Chatterton with moderate damage from tree falling on home. Not a lot of debris from trees except for isolated roads in Lake Jefferson subdivision Daws Drive and Igo Road.
September 8, 2004	F1	7K	▪ At 3:57 p.m., an F1 tornado moved from Caroline County along the Stafford-King George County line. Numerous large trees up to three feet in diameter were uprooted and had their tops ripped from them along Route 3 near Sealston. The storm was rated an F1 due to the extensive tree damage observed. Damage was estimated at $7,000.
September 17, 2004	F1	500K	▪ Tornado reported in the Fairview Beach area.

Source: NOAA 2004 and local emergency management; NA = Data not available.

4.2.4 Spotsylvania County Hazard Identification

The HMPC representatives for Spotsylvania County performed a two-stage evaluation of identified natural hazards affecting their community. First, the hazards were grouped into two categories; critical and non-critical hazards. Secondly, in conjunction with the consulting team, each critical hazard was ranked based on the threat posed to its citizens (Table 4.2.4a). Hazards that ranked critical with a medium to high hazard level were then investigated further and a vulnerability analysis was performed.

Table 4.2.4a Prioritization of Natural Hazards
Spotsylvania County

Hazard type	Critical vs. Non-Critical	Probability of Occurrence
Northeasters Winter Storms	Critical	High
Wildfire	Critical	High
Drought	Critical	Medium
Hurricanes	Critical	Medium
Tornadoes	Critical	Medium
Dam Failure	Critical	Low
Biological Hazards	Critical	Low
Thunderstorms	Non-Critical	High
Extreme Heat	Non-Critical	Medium
Flooding	Non-Critical	Medium
Earthquakes	Non-Critical	Low
Expansive Soils	Non-Critical	Low
Landslides	Non-Critical	Low

Northeasters and Winter Storms

In evaluating the localized threat of winter storms to Spotsylvania County, the HMPC analyzed local NOAA severe weather data from 1950 to 2005 to identify storms that may have posed a threat to the community. These past occurrences are presented in Table 4.2.4b. Locally, the 24 northeasters and winterstorms have caused:

- Excessive snow, sleet, and freezing rain;
- Multiple traffic accidents and delays;
- Tree and property damage;
- Power outages (over 3,000 customers in one incident); and
- Injury and loss of life.

A noted ice storm occurring during 1993 left one-third of the County without power for up to seven days. Two emergency shelters were utilized.

The probability of future occurrences is ranked as medium. With 24 events occurring between 1993 and 2004, Spotslyvania County experiences approximately 2.8 winter events per year.

Wildfire

In evaluating the localized threat of wildfires to Spotsylvania County, the HMPC analyzed data documented by the Virginia Department of Forestry (Table 4.2.4c). These data included wildfires that occurred between the years 1995-2001 with a total number of acres burned, forest or non-forest, greater than 1 acre. Fires occurring on federal lands were not included. Additionally, local emergency management noted during the wildfire season of 1987 one structure was destroyed.

Locally, the 133 wildfires have burned over 385 acres. The probability of future occurrences is ranked as medium, only one (1) incident resulted in over 30 burned at one time. A noted wildfire season occurring during 1987 destroyed two structures. Based on information from 1995-2001, Spotslyvania County averages 22.2 wildfires per year. Therefore, the probability of future occurrences is ranked as high.

Drought

According to the National Climatic Data Center, there have been nine drought events reported in RADCO region between January 1, 1950 and July 30, 2005. These past occurrences are presented in Table 4.2.4d. Locally, droughts have caused:

- Voluntary and mandatory reductions in water usage;
- Reduction in crop yields:
- Grazing losses;
- Increase in forest and brush fires; and
- Reduction in streamflow and water table.

The probability of future occurrences is ranked as medium. According to the National Weather Service, Climate Prediction Center, drought development in the RADCO region, including Spotsylvania County, is likely through December 2005.

Hurricanes

In evaluating the localized threat of hurricanes to Spotsylvania County, the HMPC analyzed local emergency management data and NOAA hurricane track data from 1851 to 2004 to identify storms that may have posed a threat to the community. The analysis included hurricanes, tropical storms, tropical depressions, and extratropical storms which passed through the region and affected the local community. These past occurrences are presented in Table 4.2.4e. Locally, the eleven (11) hurricanes have caused:

- Heavy rain;
- Gusty and high sustained winds;
- Flooding and property damage;
- Road closures; and
- Multiple power outages.

Hurricane Isabel, occurring in 2003, caused power outages in 85 percent of the County, lasting for up to nine days.

The probability of future occurrences is ranked as medium. With 11 hurricanes occurring between 1954 and 2004, Spotsylvania County experiences approximately 0.22 hurricanes per year.

Tornadoes

In evaluating the localized threat of tornadoes to Spotsylvania, the HMPC analyzed local emergency management data and NOAA severe weather data from 1950 to 2005 to identify storms that may have posed a threat to the community. Most tornado activity occurred from May to September, although a historic event in February was noted. These past occurrences are presented in Table 4.2.4f. Locally, the nine (9) tornadoes have caused:

- Property damage, including the destruction of mobile homes;
- Damage to the stage of the re-enactment of the Battle of Spotslyvania;
- Tree damage and resultant power outages; and
- Personal injury.

Noted tornadoes occurring during 1998, 2000, and 2002 have damaged homes, industrial buildings, and mobile homes:

- In 1998, a tornado along Route 17 Bypass / CSX Railroad / Route 608 Benchmark Road damaged one home and one industrial building.
- In 2000, a tornado along Hickory Ridge Road destroyed one single wide trailer. The path of the tornado started behind Berkley Elementary School and continued northeast to Route 608.
- In 2002, a tornado in the Paytes Area was spoted. No building damage was reported.

The probability of future occurrences is ranked as medium. With 9 tornadoes occurring between 1960 and 2004, Spotsylvania County experiences approximately 0.21 tornadoes per year.

Dam Failure

HMPC representatives for Spotsylvania County noted recent concerns of dam failures within the County, specifically Grant Lake within the Lake Wilderness subdivision. The dam was determined to be in an "alert condition" due to potential subsidence/sinkhole.

Table 4.2.4b
Historic Northeaster and Winter Storm Events – Spotsylvania County

Date	Event	Rain Fall (in.)	Comments
December 28, 1993	Heavy Snow	0	
January 28, 1995	Heavy Snow	0	
January 9, 1996	Heavy Snow	0	▪ Low and mid-level lift ahead of an "Alberta Clipper" added insult to injury only a day after the "Blizzard of '96", dumping 4 inches of snow in a 5 hour period near the tidal Potomac River.
January 12, 1996	Heavy Snow	350K	▪ Less than one week after the crippling "Blizzard of '96", a new winter storm dumped substantial snow across northern and western Virginia. ▪ In southern Stafford Co (VAZ055), a woman was injured when a carport collapsed. The snow changed to freezing rain and sleet along the tidal Potomac River shortly before tapering off. The changeover suppressed accumulations to 4 or 5 inches in this region. In other portions of northern Virginia, snowfall totals were as follows: in the piedmont, 5 to 7 inches; at higher elevations, 6 to 10 inches. ▪ In southern Stafford Co (VAZ055), a woman was injured when a carport collapsed. Luckily, she was protected from serious injury by the automobile, which had its windows shattered.
February 2, 1996	Heavy Snow	0	▪ A vigorous upper level jet stream induced low-level lifting of warm moist air over a stationary arctic front extending from Tidewater Virginia through the Tennessee Valley early on the 2nd, producing a 75 mile-wide band of heavy snow which extended from the central piedmont through the Northern Neck region. ▪ The heaviest snows fell in a narrow band from northern Albemarle Co through King George Co. Accumulations in these areas ranged from 8 to 13 inches, and snowfall rates were as high as 3 inches per hour.
February 2, 1996	Heavy Snow	0	▪ The continuation of a strong upper-level jet stream, combined with additional mid-level dynamics, generated surface low pressure over central Georgia by evening on the 2nd. As the low moved to near Cape Hatteras overnight, a broad area of heavy snow overspread all of northern Virginia. Areas that received 4 to 13 inches during an early morning event (on the 2nd) picked up an additional 4 to 6 inches, leaving most areas from the central piedmont through the northern neck with a grand total of 12 to 18 inches.
February 16, 1996	Heavy Snow	0	▪ A strong "Alberta Clipper", diving southeast from the upper midwest into the deep south, linked up with subtropical moisture lurking along the southeast U.S. coast to develop a classic nor'easter, which moved from northeast South Carolina to off the Virginia Capes during the day on the 16th. As the area of low pressure intensified, it wrapped Atlantic moisture well to the west, where modified arctic air was pouring in from southern Canada. The result was a thin band of heavy snow which extended from southwest Virginia through the upper eastern shore of Maryland.
February 8, 1997	Heavy Snow	25K	▪ A winter storm dumped 4 to 8 inches of heavy, wet snow across all of northern and western Virginia on the 8th.

Table 4.2.4b
Historic Northeaster and Winter Storm Events – Spotsylvania County

Date	Event	Rain Fall (in.)	Comments
January 14, 1999	Winter Weather	0	▪ A strong arctic cold front moved slowly southeast across the Mid-Atlantic region from late on the 13th to midday on the 15th. By 9am on the 15th, ice accumulations from one quarter to nearly one inch occurred north of a line from Augusta County to Spotsylvania County. The ice this storm left behind had a large impact on the region. Hundreds of car accidents, slip and fall injuries, downed trees, and power outages were reported. In Stafford County, a jackknifed tractor trailer closed State Route 3 and 621, and Interstate 95 had to be temporarily shut down to clear fallen trees. Over 215,000 customers lost power from the storm across Northern Virginia, and Central Virginia reported over 6,000 additional outages.
March 9, 1999	Winter Storm	0	▪ An area of low pressure moved from the Ohio Valley to North Carolina from late on the 8th through the evening of the 9th. Snowfall rates were in excess of 1 1/2 inches per hour in many locations during the storm. Stafford County received between 4 to 8 inches. Spotsylvania and King George County received between 2 and 6 inches. The city of Fredericksburg reported over 100 accidents. On Interstate 95 in Spotsylvania County, a woman was killed in a morning car accident.
January 20, 2000	Winter Weather	0	▪ An area of low pressure moved from west to east across the Mid-Atlantic region on the 20th, dropping 2 to 6 inches of snow between midnight and mid-afternoon. Gusty winds of 35 to 45 MPH developed during the afternoon causing the snow to drift across roadways and reduce visibilities in open areas.
January 25, 2000	Northeaster	0	▪ Low pressure off Cape Hatteras rapidly intensified late on the 24th and developed into a nor'easter which tracked northward along the Eastern Seaboard on the 25th. Very heavy snow and near-blizzard conditions were seen throughout the day east of the Blue Ridge Mountains, resulting in extremely hazardous travel conditions. Wind gusts of up to 45 MPH were recorded and several roads were drifted shut by blowing snow. The governor of Virginia declared a state of emergency as the storm battered the eastern part of the state.
January 30, 2000	Ice Storm	0	▪ Cold air was in place east of the Blue Ridge Mountains on the 29th and 30th, keeping surface temperatures below freezing. Low pressure moved from the Lower Mississippi Valley northeastward to the Mid-Atlantic region early on the 30th, creating the perfect conditions for freezing rain around the Fredericksburg area, a mix of sleet and snow east of Skyline Drive, and moderate snowfall in the mountains. Ice accumulations between 1/4 and 3/4 of an inch coated roads, trees, and power lines in Fredericksburg and Stafford, Spotsylvania, and King George Counties. Electrical outages were reported as trees and branches weighed down by ice fell onto power lines. Disruptions affected 3000 customers in Fredericksburg and Spotsylvania and King George Counties.

Table 4.2.4b
Historic Northeaster and Winter Storm Events – Spotsylvania County

Date	Event	Rain Fall (in.)	Comments
February 12, 2000	Winter Weather	0	▪ Low pressure moved from Tennessee to the North Carolina Coast on the 12th, spreading snow across the Central Shenandoah Valley and the Northern and Central Piedmont. Periods of light snow occurred from sunrise to late afternoon with accumulations ranging from 1 to 5 inches. A period of freezing drizzle also occurred around sunset.
December 13, 2000	Winter Weather	0	▪ A strong cold front brought chilly air into the region on the 12th. By the afternoon of the 13th, an upper level disturbance brought warm air into the mid levels of the atmosphere and caused snow that fell from the system to melt to rain on its way down. When the rain hit the ground where temperatures were below freezing, ice accumulated.
February 22, 2001	Winter Storm	0	▪ This system produced mainly light to moderate snowfall across the region between 9 AM and 10 PM. Snowfall amounts ranged from 2 to 5 inches. A 50 vehicle crash occurred on the northbound lanes near Masaponax in Spotsylvania County. The accident occurred as motorists crested the top of a hill, hit near zero visibility, and slammed on their breaks. Three people were treated for serious injuries and another 18 suffered minor injuries. The highway remained closed for three hours while the wreckage was cleared. A 30 vehicle pileup occurred on the southbound lanes just north of the Falmouth/Route 17 interchange in Stafford County. As whiteout conditions struck, three cars slid into each other. Within seconds, the minor fender bender turned into a pileup including tractor trailers, cars, trucks, and an empty bus. Three people were injured and the highway was blocked for nearly three hours.
January 3, 2002	Winter Storm	0	▪ Low pressure tracked across extreme southeast Virginia during the morning of the 3rd. This storm brought light to moderate snowfall to the Central Piedmont and Fredericksburg areas between 5 AM and 3 PM. In Stafford County, an inch of snow caused slippery roads and delayed school openings. In Spotsylvania and King George Counties, snowfall totals ranged from 3 to 5 inches.
January 19, 2002	Winter Weather	0	▪ Low pressure that moved across North Carolina on the 19th brought mixed precipitation to the region between 6 AM and 11 PM. In most locations, the precipitation started off in the form of snow, then changed to a mix of sleet and rain around midday.
December 5, 2002	Winter Storm	0	▪ This storm produced accumulating snowfall across the entire region as it moved by. Across the Central Piedmont and Fredericksburg area, freezing rain and sleet was mixed in with the snow. The snow and sleet accumulations ranged from 4 to 6 inches in this area.
February 6, 2003	Winter Storm	0	▪ Low pressure tracked from the Gulf Coast to the Carolinas on the 6th then off the Atlantic coast on the 7th. This storm dropped light to moderate snow between the evening of the 6th and Noon on the 7th. Accumulations ranged from 3 to 7 inches.
February 14, 2003	Winter Storm	8.9M	▪ A complex storm system produced copious amounts of wintery precipitation across the northern third of Virginia between the evening of the 14th and midday on the 18th. After the precipitation came to an end, record breaking snow and sleet accumulations were reported.

Table 4.2.4b
Historic Northeaster and Winter Storm Events – Spotsylvania County

Date	Event	Rain Fall (in.)	Comments
February 26, 2003	Winter Weather/mix	0	▪ A series of low pressure systems that tracked from the Gulf Coast to Cape Hatteras dropped light snow off and on between the morning of the 26th and midday on the 28th. A total of 5 to 8 inches of snow accumulated across the northern third of Virginia during the storm. Minor traffic accidents were reported after the fallen snow made roads slippery.
December 14, 2003	Winter Weather/mix	0	▪ An area of low pressure developed over the Gulf Coast region and tracked northeast into the Mid Atlantic region. The storm produced a mixture of snow, sleet and freezing rain. Snowfall totals across Northeast Virginia averaged 3 to 4 inches.
January 25, 2004	Winter Weather/mix	0	▪ An area of low pressure developed off the coast of North Carolina and tracked north. This storm produced widespread snow, sleet and freezing drizzle over the region. Two to four inches of snow fell over the Central Foothills and the Northern Piedmont of Virginia. The snow mixed with sleet and finally changed over to freezing drizzle before tapering off. Several other minor accidents occurred according to Emergency Operations Centers. Dozens of school districts closed.

Source: National Climatic Data Center, 2005.

Table 4.2.4c
Historic Wildfire Events – Spotsylvania County

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
01/14/1995	2	0	0	Smoking
02/22/1995	2	0	180000	Children
02/23/1995	20	2700	300800	Debris Burning
02/24/1995	1	1000	2000	Incendiary
03/14/1995	1	400	100000	Debris Burning
03/17/1995	1	100	0	Children
03/17/1995	1	800	29000	Debris Burning
03/19/1995	1	0	200000	Incendiary
03/22/1995	1	250	0	Children
03/26/1995	1	0	0	Smoking
03/27/1995	1	100	0	Debris Burning
03/31/1995	1	300	205000	Debris Burning
04/02/1995	4	100	201400	Children
04/02/1995	1	100	0	Children
04/04/1995	3	1000	0	Smoking
04/08/1995	2	5700	31000	Miscellaneous
04/08/1995	1	5000	450000	Children
04/15/1995	1	500	40000	Children
04/21/1995	1	200	0	Smoking
04/27/1995	1	200	0	Debris Burning
03/05/1996	1	100	0	Children
03/13/1996	3	0	90000	Debris Burning
03/16/1996	2	0	200000	Smoking
03/23/1996	2	0	0	Debris Burning
03/25/1996	2	0	310000	Debris Burning
03/25/1996	1	100	300000	Debris Burning
04/08/1996	1	0	80000	Children
04/08/1996	1	500	75000	Miscellaneous
04/19/1996	1	700	600000	Children
04/23/1996	7	10500	2000	Debris Burning
04/23/1996	3	0	500000	Miscellaneous
04/25/1996	2	300	162000	Debris Burning
02/19/1997	2	100	200000	Miscellaneous
02/21/1997	1	0	0	Smoking
02/25/1997	4	0	0	Smoking
03/06/1997	1	0	0	Miscellaneous
03/11/1997	2	200	60500	Debris Burning
03/11/1997	1	0	0	Smoking
03/12/1997	1	0	0	Children
03/12/1997	1	100	50	Miscellaneous
03/16/1997	1	200	150000	Debris Burning
03/24/1997	2	400	40000	Debris Burning
03/27/1997	1	0	500000	Children
03/30/1997	1	100	0	Children
04/01/1997	4	200	20000	Children
04/01/1997	2	400	550000	Equipment Use
04/02/1997	3	500	500	Children
04/03/1997	3	0	50000	Smoking
04/07/1997	5	500	100500	Debris Burning
04/19/1997	1	150	0	Smoking
04/30/1997	2	400	0	Children

Table 4.2.4c
Historic Wildfire Events – Spotsylvania County

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
05/12/1997	1	300	90000	Debris Burning
05/20/1997	5	0	0	Debris Burning
05/28/1997	3	400	0	Smoking
07/14/1997	1	100	400	Smoking
08/01/1997	1	0	0	Debris Burning
08/29/1997	1	0	0	Railroad
03/14/1998	2	50	5025	Debris Burning
03/29/1998	4	0	0	Debris Burning
03/29/1998	1	0	0	Children
04/02/1998	1	100	0	Debris Burning
04/06/1998	2	0	0	Debris Burning
04/07/1998	1	100	0	Children
04/13/1998	1	0	0	Children
04/13/1998	1	400	0	Children
04/13/1998	1	200	0	Children
08/05/1998	7	100	160000	Debris Burning
08/06/1998	1	0	0	Miscellaneous
09/06/1998	2	0	0	Debris Burning
09/07/1998	2	0	0	Children
09/09/1998	1	100	80000	Lightning
10/18/1998	1	900	0	Smoking
10/28/1998	2	500	305000	Debris Burning
11/01/1998	1	500	1000000	Campfire
11/02/1998	1	500	0	Miscellaneous
11/08/1998	1	100	0	Children
11/28/1998	1	100	0	Incendiary
11/30/1998	4	100	190000	Debris Burning
12/01/1998	1	500	0	Campfire
12/02/1998	1	500	2000000	Children
12/19/1998	1	0	80000	Children
03/18/1999	38	1200	300000	Debris Burning
03/28/1999	2	500	315000	Debris Burning
03/28/1999	1	100	750000	Smoking
03/30/1999	2	0	0	Equipment Use
03/31/1999	8	2000	305000	Debris Burning
04/14/1999	3	800	0	Smoking
04/17/1999	6	2200	3000	Smoking
04/17/1999	2	200	311000	Smoking
05/11/1999	1	0	2000	Smoking
05/21/1999	1	200	0	Children
08/05/1999	30	5000	505000	Debris Burning
08/07/1999	1	400	75000	Children
08/08/1999	2	0	0	Children
08/11/1999	1	0	0	Equipment Use
11/07/1999	3	100	0	Children
11/16/1999	3	100	255000	Miscellaneous
01/13/2000	3	500	250500	Miscellaneous
02/25/2000	1	0	0	Miscellaneous
03/04/2000	1	0	0	Incendiary
03/05/2000	3	200	0	Campfire
03/05/2000	1	0	0	Campfire

Table 4.2.4c
Historic Wildfire Events – Spotsylvania County

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
03/15/2000	1	400	150000	Debris Burning
03/27/2000	1	0	0	Children
03/31/2000	1	500	20000	Debris Burning
04/01/2000	2	500	102000	Debris Burning
04/01/2000	1	6500	12000	Debris Burning
04/13/2000	1	0	100	Equipment Use
10/18/2000	1	0	73000	Debris Burning
01/30/2001	10	1000	100000	Miscellaneous
01/30/2001	4	1500	303500	Debris Burning
01/30/2001	2	0	0	Miscellaneous
01/30/2001	1	0	0	Debris Burning
04/10/2001	13	1000	0	Incendiary
04/10/2001	1	700	400	Debris Burning
04/15/2001	9	250	0	Debris Burning
04/19/2001	1	200	0	Children
04/20/2001	2	200	115000	Debris Burning
04/22/2001	9	400	0	Incendiary
04/30/2001	1	0	0	Debris Burning
07/16/2001	4	1000	0	Miscellaneous
07/16/2001	1	0	0	Debris Burning
07/17/2001	1	0	0	Smoking
08/20/2001	17	500	0	Incendiary
10/22/2001	5	0	0	Campfire
11/05/2001	3	100	1000	Debris Burning
11/06/2001	1	50	130000	Debris Burning
11/12/2001	2	300	0	Miscellaneous
11/12/2001	1	500	60000	Smoking
11/14/2001	1	1000	0	Incendiary
11/17/2001	1	0	0	Smoking
04/10/2001	1	700	400	Debris Burning
04/15/2001	9	250	0	Debris Burning
Totals	**385**	**$70,500**	**$13,779,705**	

Source: Virginia Department of Forestry, 2005.

Table 4.2.4d
Historic Drought Events – Spotsylvania County

Date	Crop Damage ($)	Descriptions
August 7, 1995	0	▪ Dry weather, combined with periods of excessive heat, caused some damage to several crops, and limited the production of healthy livestock, during a month-long period that extended through mid-September. August, normally one of the wettest months, was the sixth-driest on record at Washington/National Airport (Arlington County), with barely seven-eighths of an inch (normal: 3.91 inches). Across the region, monthly precipitation averaged one to two inches, with virtually all of it falling before August 7th. The drought continued into mid-September, when it was alleviated somewhat by steady rains late on the 16th and early on the 17th. However, mean temperatures were much lower in September, ironically due to drier air masses, which allowed temperatures to plummet into the 50s on several mornings. Nonetheless, Washington/National broke an all-time record for consecutive days without measurable precipitation, with 33.
August 1, 1998	0	▪ Persistent high pressure brought unusually dry weather during the entire month for much of northern and central Virginia. Only 0.45 inches of rain fell at Washington Dulles Airport, which was significantly less than the normal of 3.94 inches. Similar readings were found across most of central and northern Virginia. The lack of rainfall substantially reduced crop yields. The lack of rainfall also contributed to increasingly dry timber and brush. The U.S. Forest Service reported the George Washington and Jefferson National Forests were twice as dry as normal, and five fires broke out in these parks during the first week of the month. A water emergency was declared in Spotsylvania Co (VAZ056) on the 30th as the Ni River reservoir had neared dangerously low levels.
November 1, 1998	0	▪ This was the fifth month in a row that drought conditions were seen across Northern Virginia. Persistent high pressure over the Southeast U.S. forced rain producing low pressure systems to steer north of the region. Only 0.91 inches of rain fell at Reagan National Airport in Arlington County during the month of November, 2.19 inches below normal. The 5 month total at the airport was only 5.78 inches, 11.38 inches below normal. The independent cities of Fredericksburg received only 1.0 inches. By the end of the month, the Ni Reservoir, main water supply in Spotsylvania County, had only backup reserve water left and was at a record low level. The county was forced to continue mandatory water restrictions and buy additional water from Stafford County. The agricultural community continued to suffer through the second worst drought in the past 100 years. This was the first year the Farm Service Agency had to make direct payments for grazing losses. The drought has also contributed to a nearly unprecedented amount of forest and brush fires. Sixty-five fires were reported across Virginia between November 1st and 20th. Stafford County reported several significant brush fires during the month, and dozens of smaller fires burned in several other locations.
December 1, 1998	0	▪ This was the sixth month in a row that drought conditions were seen across Northern Virginia. Only 1.74 inches of precipitation fell at Washington Reagan National Airport in Arlington County during December, 1.38 inches below normal. In the past 127 years, only one other July through December on record (1930) received less precipitation than the last half of 1998. The 6 month total at the airport was only 7.45 inches, 12.82 inches below normal. The Ni Reservoir, main water supply in Spotsylvania County, remained at a record low level through the month. Mandatory water restrictions continued across the county for the fifth straight month, and on the 8th, county businesses were banned from using water outdoors. The Palmer Index rated Northern Virginia in a severe to extreme drought, and the Governor declared a state of emergency across Virginia on December 1st due to the dry weather and resulting extreme fire danger. An open burning ban continued across Virginia through December 10th.

Table 4.2.4d
Historic Drought Events – Spotsylvania County

Date	Crop Damage ($)	Descriptions
May 1, 1999	0	▪ High pressure was the dominant weather feature across Northern Virginia during the month. Conditions on the Shenandoah and Rappahannock River were also extremely dry. Some stations in these two watersheds reported streamflow at or below the 90th percentile exceedence, which rivaled minimum daily mean flow values of the drought of 1980-82. With such low water tables, Spotsylvania County was forced to reinstate voluntary water restrictions. The Ni River Reservoir, main water source for the county, had already dipped 4 inches below the spillway by mid month. The lack of precipitation also played havoc with spring planting and livestock maintenance. Trees were prematurely shedding leaves in orchards, hay and pastureland were wilting, and watering holes and irrigation sources were slowly drying up.
June 1, 1999	0	▪ High pressure was the dominant weather feature across Northern Virginia during the month. This weather pattern directed rain producing low pressure systems north of the region and continued the climatological drought that has gripped the area since last summer. By the last week of June, the Palmer Drought Index, a measure of long term drought conditions, indicated Northern Virginia was in a severe drought. Flows in the Potomac, Shenandoah, and Rappahannock basins, were equal to or slightly below minimum June daily mean flow values recorded during the 1980-82 drought. Many gaging stations reported streamflow at or below the 90 percent exceedence, and a few reported streamflow values at or below the 95th percentile. Streamflow of the Rappahannock River at Fredericksburg was only 14% of normal. With such low water tables, the city of Fredericksburg was forced to start voluntary water restrictions. The Ni River Reservoir, main water source for Spotsylvania County, dipped 16 inches below full by mid month.
July 1, 1999	83.0M	▪ High pressure was the dominant weather feature across Northern Virginia during the month. This forced most rain producing storm systems to steer north of the region and resulted in the continuation of the climatological, meteorological, and hydrological drought that had plagued the area since last summer. Many stations on the Shenandoah and Rappahannock watersheds reported streamflow at or below the 90 percent exceedence, which rivaled minimum daily mean flow values of the drought of 1980-82. The Rappahannock River was approaching 10% of normal flow, and west of Fredericksburg was flowing with just a few feet of water. Twenty miles upstream of Fredericksburg, the river was too shallow for canoes. The Ni River Reservoir, main water source for Spotsylvania County, dipped 4 inches below the spillway by mid month. In addition to agricultural lands, forest and rural vegetation were also dangerously dry. The Virginia Department of Forestry reported a record fire season January through July, 1320 fires burning 6146 acres. This number already exceeded the amount of fires reported in 1998. During the month of July alone, 61 fires burned 280 acres. The Cumulative Severity Index, a measure of fire danger which ranges from 1 to 800, gave Northern Virginia a rating of 628 by month's end. Animal control officials also attributed an increase of wildlife entering populated areas in search of food and water to the drought.
August 1, 1999	41.7M	▪ High pressure was the dominant weather feature across Northern Virginia through the 24th of August. Most rain producing storm systems steered north of the region through the period. This resulted in the continuation of the climatological, meteorological, and hydrological drought which has plagued the area since last summer. Heavy rain fell east of the Blue Ridge Mountains on the 25th and 27th, helping to fill surface reservoirs. Unfortunately, because most of the rain fell in the form of thunderstorm downpours, most of the moisture ran off into rivers before it had the chance to seep into the aquifer supply.

Table 4.2.4d
Historic Drought Events – Spotsylvania County

Date	Crop Damage ($)	Descriptions
September 1, 1999	5.0M	▪ Rainfall from two land falling hurricanes made a tremendous impact on the drought that plagued the region since the summer of 1998. Across Northern Virginia, the greatest amount of rain fell north of a line from Staunton to Fredericksburg. The water shortage came to an end in this area by mid month. Locations to the south recorded a major increase in water supplies, upgrading their condition from an extreme drought to a mild drought, but not enough rain fell to completely wipe out the shortage. The Ni River Reservoir returned to 71% of its capacity by the end of the month, allowing officials in Spotsylvania County to lift mandatory water restrictions that were in effect for 13 months.

Source: National Climatic Data Center, 2005.

Table 4.2.4e
Historic Hurricane Events – Spotsylvania County

Storm Name	Date	Category	Total Est. Damage	Descriptions
Hazel	October 15, 1954	Hurricane	Unknown	▪ The Free-Lance Star reported flooding and property damage.
Connie	August 12, 1955	Hurricane	Unknown	▪ The Free-Lance Star reported flooding and property damage.
Diane	August 17, 1955	Hurricane	Unknown	▪ The Free-Lance Star reported flooding and property damage.
Camille	September 1960	Hurricane	Unknown	▪ The Free-Lance Star reported massive flooding.
Floyd	September 16, 1999	Tropical Storm	No estimate available.	▪ Gusty winds from 30 to 50 mph ▪ 16,000 power outages ▪ 5.97 inches in Spotsylvania ▪ In Spotsylvania County, several trees were downed and high water closed several roads in the eastern portion of the county.
Isabel	September 18, 2003	Tropical Storm	$55.1 million – property $130,000 – crop	▪ 85% of County was without power for up to 9 days
Charley And Bonnie	August 18, 2004	Hurricane	Unknown	▪ Highest sustained wind was 73 mph ▪ Uprooted trees and downed numerous power lines ▪ Over 2 million Virginians without power ▪ Heavy rain and wind gust
Gaston	August 30, 2004	Tropical Depression	Unknown	▪ Hard rains that processed flooding ▪ Roads under water ▪ Power outage (99,600 statewide)
Frances	September 8, 2004	Hurricane	Unknown	
Ivan	September 17, 2004	Hurricane	Unknown	▪ Spawned unconfirmed tornadoes ▪ Power outage (66,000) Heavy rain/flooding
Jeanne	September 28, 2004	Hurricane	Unknown	▪ Flash flooding/heavy rainfall ▪ Power outage

Source: NOAA 2004, VWC 2004, and local emergency management.

Table 4.2.4f
Historic Tornado Events – Spotsylvania County

Date	Magnitude	Property Damage ($)	Descriptions
February 18, 1960	F1	0K	
September 5, 1979	F1	250K	
1998	F1	NA	▪ Local emergency management reports tornado activity along the Rt. 17 Bypass / CSX Railroad / Rt. 608 Benchmark Road. One home and one industrial building are damaged.
July 2, 1999	F1	10K	▪ Parts of southern Spotsylvania County lost power after downed trees fell onto power lines ▪ Most of the downed trees were in the Falmouth area.
2000	F1	NA	▪ Local emergency management reports tornado activity along Hickery Ridge Road destroying one single-wide trailer. The area impacted started behind Berkeley Elementary School continuing northeast to Rte. 1 and 608.
2002	F1	NA	▪ Local emergency management reports tornado activity in the Paytes area. No building damage was reported.
July 10, 2003	F0	0K	▪ F0 tornado touched down approximately 5 miles southeast of Falmouth near Route 3 ▪ The tornado moved northeast and damaged trees until it lifted near Route 218 on the Spotsylvania County line
May 7, 2004	F1	10K	▪ At 7:51 p.m., an F1 tornado touched down near Shiloh. At least a dozen dwellings and 10 boats were damaged. Several trees were also uprooted or had their tops ripped out along the storm's three-mile path. In Stafford County, 80 to 90 mph winds destroyed two homes and caused major damage to 20 others. The Japazawas Subdivision in eastern Stafford County had approximately 40 trees down. Three Amtrak trains were stalled between the Chatham area of Stafford and Fredericksburg due to downed trees and power lines. In the County of Spotsylvania, the main stage at the re-enactment of the Battle of Spotsylvania collapsed due to strong winds. A number of tents and a couple of portable toilets were also blown over. Estimated damages were $10,000.
September 17, 2004	FO	500K	▪ F0 tornado touched down approximately 5 miles southeast of Falmouth near Route 3 ▪ A thunderstorm moved from Spotsylvania County into the eastern portion of the City of Fredericksburg. No property damage was reported, with debris scattered along Dixon Street. ▪ At 4:29 p.m., emergency personnel witnessed a weak tornado in the New Crest Area that caused minor damage to homes and trees. ▪ At 5:05 p.m., a brief tornado touched down near Holladay. It was video taped by a local fire fighter. No damage or injuries were reported.

Source: NOAA 2004 and local emergency management; NA = Data not available.

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4.2.5 Stafford County Hazard Identification

The HMPC representatives for Stafford County performed a two-stage evaluation of identified natural hazards affecting the RADCO region. First, the hazards were grouped into two categories; critical and non-critical hazards. Secondly, in conjunction with the consulting team, each critical hazard was ranked based on the threat posed to its citizens (Table 4.2.5a). Hazards that ranked critical with a medium to high hazard level were then investigated further and a vulnerability analysis was performed.

Table 4.2.5a Prioritization of Natural Hazards
Stafford County

Hazard type	Critical vs. Non-Critical	Probability of Occurrence
Flooding	Critical	High
Northeasters Winter Storms	Critical	High
Wildfire	Critical	High
Hurricanes	Critical	Medium
Tornadoes	Critical	Medium
Biological Hazards	Critical	Low
Dam Failure	Critical	Low
Thunderstorms	Non-Critical	High
Drought	Non-Critical	Low
Earthquakes	Non-Critical	Low
Expansive Soils	Non-Critical	Low
Extreme Heat	Non-Critical	Low
Landslides	Non-Critical	Low

Flooding

Flooding in Stafford County can occur at any time throughout the year but is more frequent during the fall and spring. The most severe flooding events have been associated with intense rainfall from hurricanes and tropical storms. The FIS has identified the historic flooding events listed in Table 4.2.5b.

Table 4.2.5b
Historic Flood Events – Stafford County

Year of flood	Discharge (cfs)	Recurrence Interval (years)
1937	134,000	135
1943*	140,000	140
1955	74,000	20
1972	107,000	30

*The flood of 1943 crested 45 feet above normal levels.
Source: FEMA 1992

The Federal Emergency Management Agency (FEMA) has published a Flood Insurance Study (FIS) for Stafford County, dated February 4, 2005. The Flood Insurance Rate Maps (FIRMs), which accompany this FIS, delineate the 100- and 500-year flood hazard boundaries for flooding sources identified in areas of growing development or areas predicted to have future development at the time of the report. The FIRM Index for Stafford County is provided in Appendix B. Individual FIRM panels are available at the FEMA Map Service Center (http://msc.fema.gov/). Table 4.2.5c identifies those streams within the County on which FEMA has performed detailed engineering analysis and, as a result of that analysis, has developed flood elevations and a floodway. Other streams within the County were studied by FEMA by approximate methods. These streams have a 100-year flood hazard boundary, but flood elevations and floodways have not been calculated.

Table 4.2.5c
Water Bodies in Stafford County Studied by Detailed Methods

Stream Name	
Accokeek Creek	Potomac Creek
Aquia Creek	Rappahannock River
Austin Run	Rappahannock River: Left Channel
Tributary 3 to Austin Run	Tributary 1 to Rappahannock River
Claiborne Run	Rocky Run
England Run	Tributary 1 to Chopawamsic Creek
Falls Run	Whitsons Run
Little Falls Run	

Source: FEMA 2005

The Potomac River forms the eastern border of the County and also poses a flooding threat due to tidal flooding associated with the river. The cyclical rise and fall of coastal waters are linked to the gravitational attraction of the moon and the sun. In this area the tide range is 1-2 feet (FEMA 1992) depending on location. Tidal fluctuations in nature occur independent of climatic changes. Therefore, the position of the tide can amplify the effects of rising floodwaters. The 100-year still water elevations for the Potomac River range from 7.4 to 7.7 feet (NGVD 1929) (FEMA 1992).

Noted Problem Areas
HMPC representatives for Stafford County noted several areas within the community that are affected by frequent flooding. These include:

- Repeated road closures due to flooding and debris at:
  - River Road;
  - Vista Woods, Grafton Village, and Argyle Hills;
  - Harrell Road at the CSX Crossing; and
  - Aquia Drive, requiring emergency access from Decatur Road.
- Riverine flooding in several neighborhoods including:
  - The Falmouth area, which is often evacuated; and
  - The Aquia Harbour area with over 1000 homes affected.
- Tidal flooding at the marina area.

The probability of future occurrences is ranked as high. A 100-year event has a one percent probability of occurring in any given year. The 100-year floodplains for Stafford County have been identified and are presented in the FIRM index in Appendix B.

Northeasters and Winter Storms

In evaluating the localized threat of winter storms to Stafford County, the HMPC analyzed local NOAA severe weather data from 1950 to 2005 to identify storms that may have posed a threat to the community. These past occurrences are presented in Table 4.2.5d. Locally, the 24 northeasters and winter storms have caused:

- Excessive snow, sleet, and freezing rain;
- Multiple traffic accidents (noted incident on Route 17) and delays;
- Tree and property damage;
- Power outages; and
- Injury and loss of life.

A noted winter weather event during 2002 resulted in a traffic accident involving over 100 vehicles on southbound interstate 95 due to icy and white-out conditions. The interstate was closed for several hours. Additional traffic accidents during the 2004 winter season resulted in the death of 3 teenagers, in separate accidents, due to wet or icy road conditions.

The probability of future occurrences is ranked as medium. With 24 events occurring between 1993 and 2004, Stafford County experiences approximately 2.8 winter events per year.

Wildfire

In evaluating the localized threat of wildfires to Stafford County, the HMPC analyzed data documented by the Virginia Department of Forestry (Table 4.2.5e). These data included wildfires that occurred between the years 1995-2001 with a total number of acres burned, forest or non-forest, greater than 1 acre. Fires occurring on federal lands were not included.

Locally, the 50 wildfires have burned over 111 acres. Only two incidences resulted in 7 acres burned at one time. Based on information from 1995-2001, Stafford County averages 8.3 wildfires per year. Therefore, the probability of future occurrences is ranked as high.

Hurricanes

In evaluating the localized threat of hurricanes to Stafford County, the HMPC analyzed NOAA hurricane track data from 1851 to 2004 to identify storms that may have posed a threat to the community. The analysis included hurricanes, tropical storms, tropical depressions, and extratropical storms which passed through the region and affected the local community. These past occurrences are presented in Table 4.2.5f. Locally, the eleven (11) hurricanes have caused:

- Heavy rain;
- Gusty and high sustained winds;
- Flooding and property damage;
- Road closures; and
- Multiple power outages.

The probability of future occurrences is ranked as medium. With 11 hurricanes occurring between 1954 and 2004, Stafford County experiences approximately 0.22 hurricanes per year.

Tornadoes

In evaluating the localized threat of tornadoes to Stafford County, the HMPC analyzed local emergency management data and NOAA severe weather data from 1950 to 2005 to identify storms that may have posed a threat to the community. Most tornado activity occurred from May to September, although a

historic event in February was noted. These past occurrences are presented in Table 4.2.5g. Locally, the seven (7) tornadoes have caused:

- Property damage, including the displacement of boats in dry dock;
- Damage to the stage of the re-enactment of the Battle of Spotslyvania;
- Tree damage and resultant power outages.

Noted tornadoes occurring during 2003 and 2004 damaged homes, downed trees, and caused power outages for several days.

- In 2003, a tornado along the Belle Plains Area damaged homes due to wind and fallen trees. Power outages lasted for several days.

- In 2004, a tornado along the Stafford and Gavisonville Road Area caused damage to trees and homes. Wind damage to a trailer park in the Widewater / Boswells Corner area was noted.

The probability of future occurrences is ranked as medium. With 7 tornadoes occurring between 1960 and 2004, Stafford County experiences approximately 0.16 tornadoes per year.

Table 4.2.5d
Historic Northeaster and Winter Storm Events – Stafford County

Date	Event	Property Damage ($)	Comments
December 28, 1993	Heavy Snow	0	
January 28, 1995	Heavy Snow	0	
January 9, 1996	Heavy Snow	0	▪ Low and mid-level lift ahead of an "Alberta Clipper" added insult to injury only a day after the "Blizzard of '96", dumping 4 inches of snow in a 5 hour period near the tidal Potomac River.
January 12, 1996	Heavy Snow	350K	▪ Less than one week after the crippling "Blizzard of '96", a new winter storm dumped substantial snow across northern and western Virginia. ▪ In southern Stafford Co (VAZ055), a woman was injured when a carport collapsed. The snow changed to freezing rain and sleet along the tidal Potomac River shortly before tapering off. The changeover suppressed accumulations to 4 or 5 inches in this region. In other portions of northern Virginia, snowfall totals were as follows: in the piedmont, 5 to 7 inches; at higher elevations, 6 to 10 inches. ▪ In southern Stafford Co (VAZ055), a woman was injured when a carport collapsed. Luckily, she was protected from serious injury by the automobile, which had its windows shattered.
February 2, 1996	Heavy Snow	0	▪ A vigorous upper level jet stream induced low-level lifting of warm moist air over a stationary arctic front extending from Tidewater Virginia through the Tennessee Valley early on the 2nd, producing a 75 mile-wide band of heavy snow which extended from the central piedmont through the Northern Neck region. ▪ The heaviest snows fell in a narrow band from northern Albemarle Co through King George Co. Accumulations in these areas ranged from 8 to 13 inches, and snowfall rates were as high as 3 inches per hour.
February 2, 1996	Heavy Snow	0	▪ The continuation of a strong upper-level jet stream, combined with additional mid-level dynamics, generated surface low pressure over central Georgia by evening on the 2nd. As the low moved to near Cape Hatteras overnight, a broad area of heavy snow overspread all of northern Virginia. Areas that received 4 to 13 inches during an early morning event (on the 2nd) picked up an additional 4 to 6 inches, leaving most areas from the central piedmont through the northern neck with a grand total of 12 to 18 inches.
February 16, 1996	Heavy Snow	0	▪ A strong "Alberta Clipper", diving southeast from the upper midwest into the deep south, linked up with subtropical moisture lurking along the southeast U.S. coast to develop a classic nor'easter, which moved from northeast South Carolina to off the Virginia Capes during the day on the 16th. As the area of low pressure intensified, it wrapped Atlantic moisture well to the west, where modified arctic air was pouring in from southern Canada. The result was a thin band of heavy snow which extended from southwest Virginia through the upper eastern shore of Maryland.
February 8, 1997	Heavy Snow	25K	▪ A winter storm dumped 4 to 8 inches of heavy, wet snow across all of northern and western Virginia on the 8th.

Table 4.2.5d
Historic Northeaster and Winter Storm Events – Stafford County

Date	Event	Property Damage ($)	Comments
January 14, 1999	Winter Weather	0	▪ A strong arctic cold front moved slowly southeast across the Mid-Atlantic region from late on the 13th to midday on the 15th. By 9am on the 15th, ice accumulations from one quarter to nearly one inch occurred north of a line from Augusta County to Spotsylvania County. The ice this storm left behind had a large impact on the region. Hundreds of car accidents, slip and fall injuries, downed trees, and power outages were reported. In Stafford County, a jackknifed tractor trailer closed State Route 3 and 621, and Interstate 95 had to be temporarily shut down to clear fallen trees. Over 215,000 customers lost power from the storm across Northern Virginia, and Central Virginia reported over 6,000 additional outages.
March 9, 1999	Winter Storm	0	▪ An area of low pressure moved from the Ohio Valley to North Carolina from late on the 8th through the evening of the 9th. Snowfall rates were in excess of 1 1/2 inches per hour in many locations during the storm. Stafford County received between 4 to 8 inches. Spotsylvania and King George County received between 2 and 6 inches. The city of Fredericksburg reported over 100 accidents. On Interstate 95 in Spotsylvania County, a woman was killed in a morning car accident.
January 20, 2000	Winter Weather	0	▪ An area of low pressure moved from west to east across the Mid-Atlantic region on the 20th, dropping 2 to 6 inches of snow between midnight and mid-afternoon. Gusty winds of 35 to 45 MPH developed during the afternoon causing the snow to drift across roadways and reduce visibilities in open areas.
January 25, 2000	Northeaster	0	▪ Low pressure off Cape Hatteras rapidly intensified late on the 24th and developed into a nor'easter which tracked northward along the Eastern Seaboard on the 25th. Very heavy snow and near-blizzard conditions were seen throughout the day east of the Blue Ridge Mountains, resulting in extremely hazardous travel conditions. Wind gusts of up to 45 MPH were recorded and several roads were drifted shut by blowing snow. The governor of Virginia declared a state of emergency as the storm battered the eastern part of the state.
January 30, 2000	Ice Storm	0	▪ Cold air was in place east of the Blue Ridge Mountains on the 29th and 30th, keeping surface temperatures below freezing. Low pressure moved from the Lower Mississippi Valley northeastward to the Mid-Atlantic region early on the 30th, creating the perfect conditions for freezing rain around the Fredericksburg area, a mix of sleet and snow east of Skyline Drive, and moderate snowfall in the mountains. Ice accumulations between 1/4 and 3/4 of an inch coated roads, trees, and power lines in Fredericksburg and Stafford, Spotsylvania, and King George Counties. Electrical outages were reported as trees and branches weighed down by ice fell onto power lines. Disruptions affected 3000 customers in Fredericksburg and Spotsylvania and King George Counties.
February 12, 2000	Winter Weather	0	▪ Low pressure moved from Tennessee to the North Carolina Coast on the 12th, spreading snow across the Central Shenandoah Valley and the Northern and Central Piedmont. Periods of light snow occurred from sunrise to late afternoon with accumulations ranging from 1 to 5 inches. A period of freezing drizzle also occurred around sunset.

Table 4.2.5d
Historic Northeaster and Winter Storm Events – Stafford County

Date	Event	Property Damage ($)	Comments
December 13, 2000	Winter Weather	0	▪ A strong cold front brought chilly air into the region on the 12th. By the afternoon of the 13th, an upper level disturbance brought warm air into the mid levels of the atmosphere and caused snow that fell from the system to melt to rain on its way down. When the rain hit the ground where temperatures were below freezing, ice accumulated.
February 22, 2001	Winter Storm	0	▪ This system produced mainly light to moderate snowfall across the region between 9 AM and 10 PM. Snowfall amounts ranged from 2 to 5 inches. A 50 vehicle crash occurred on the northbound lanes near Masaponax in Spotsylvania County. The accident occurred as motorists crested the top of a hill, hit near zero visibility, and slammed on their breaks. Three people were treated for serious injuries and another 18 suffered minor injuries. The highway remained closed for three hours while the wreckage was cleared. A 30 vehicle pileup occurred on the southbound lanes just north of the Falmouth/Route 17 interchange in Stafford County. As whiteout conditions struck, three cars slid into each other. Within seconds, the minor fender bender turned into a pileup including tractor trailers, cars, trucks, and an empty bus. Three people were injured and the highway was blocked for nearly three hours.
January 3, 2002	Winter Storm	0	▪ Low pressure tracked across extreme southeast Virginia during the morning of the 3rd. This storm brought light to moderate snowfall to the Central Piedmont and Fredericksburg areas between 5 AM and 3 PM. In Stafford County, an inch of snow caused slippery roads and delayed school openings. In Spotsylvania and King George Counties, snowfall totals ranged from 3 to 5 inches.
January 19, 2002	Winter Weather	0	▪ Low pressure that moved across North Carolina on the 19th brought mixed precipitation to the region between 6 AM and 11 PM. In most locations, the precipitation started off in the form of snow, then changed to a mix of sleet and rain around midday.
December 5, 2002	Winter Storm	0	▪ This storm produced accumulating snowfall across the entire region as it moved by. Across the Central Piedmont and Fredericksburg area, freezing rain and sleet was mixed in with the snow. The snow and sleet accumulations ranged from 4 to 6 inches in this area.
February 6, 2003	Winter Storm	0	▪ Low pressure tracked from the Gulf Coast to the Carolinas on the 6th then off the Atlantic coast on the 7th. This storm dropped light to moderate snow between the evening of the 6th and Noon on the 7th. Accumulations ranged from 3 to 7 inches.
February 14, 2003	Winter Storm	8.9M	▪ A complex storm system produced copious amounts of wintery precipitation across the northern third of Virginia between the evening of the 14th and midday on the 18th. After the precipitation came to an end, record breaking snow and sleet accumulations were reported.
February 26, 2003	Winter Weather/mix	0	▪ A series of low pressure systems that tracked from the Gulf Coast to Cape Hatteras dropped light snow off and on between the morning of the 26th and midday on the 28th. A total of 5 to 8 inches of snow accumulated across the northern third of Virginia during the storm. Minor traffic accidents were reported after the fallen snow made roads slippery.
December 14, 2003	Winter Weather/mix	0	▪ An area of low pressure developed over the Gulf Coast region and tracked northeast into the Mid Atlantic region. The storm produced a mixture of snow, sleet and freezing rain.

Table 4.2.5d
Historic Northeaster and Winter Storm Events – Stafford County

Date	Event	Property Damage ($)	Comments
			Snowfall totals across Northeast Virginia averaged 3 to 4 inches.
January 25, 2004	Winter Weather/mix	0	▪ An area of low pressure developed off the coast of North Carolina and tracked north. This storm produced widespread snow, sleet and freezing drizzle over the region. Two to four inches of snow fell over the Central Foothills and the Northern Piedmont of Virginia. The snow mixed with sleet and finally changed over to freezing drizzle before tapering off. Several other minor accidents occurred according to Emergency Operations Centers. Dozens of school districts closed.

Source: National Climatic Data Center, 2005.

Table 4.2.5e
Historic Wildfire Events – Stafford County

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
03/25/1995	2	500	260000	Campfire
03/27/1995	1	200	0	Children
04/01/1995	3	500	0	Children
04/04/1995	3	1200	205000	Miscellaneous
04/07/1995	3	500	200000	Children
04/09/1995	1	500	46000	Smoking
04/22/1995	3	0	0	Miscellaneous
04/24/1995	1	0	0	Children
03/06/1996	1	0	36000	Miscellaneous
03/16/1996	2	0	7500	Debris Burning
04/17/1996	2	0	0	Incendiary
04/17/1996	1	0	0	Incendiary
04/23/1996	1	0	250000	Smoking
03/16/1997	2	0	0	Children
03/22/1997	1	0	0	Miscellaneous
03/24/1997	1	100	0	Debris Burning
04/02/1997	1	100	0	Debris Burning
03/28/1998	2	0	0	Children
03/31/1998	3	500	0	Debris Burning
03/31/1998	1	0	0	Miscellaneous
03/31/1998	1	100	0	Debris Burning
04/02/1998	3	200	0	Children
04/02/1998	3	300	95000	Debris Burning
04/02/1998	2	0	0	Debris Burning
04/05/1998	1	0	0	Miscellaneous
04/06/1998	7	0	0	Smoking
04/06/1998	1	0	0	Children
04/13/1998	5	0	0	Children
10/29/1998	5	500	0	Smoking
10/30/1998	1	500	500000	Debris Burning
12/30/1998	1	0	0	Children
03/20/1999	1	0	0	Children
03/29/1999	1	0	0	Miscellaneous
03/30/1999	4	0	0	Miscellaneous
03/31/1999	1	500	100000	Debris Burning
04/06/1999	3	1000	0	Children
04/06/1999	2	1200	200000	Children
04/08/1999	5	1500	1518000	Children
04/08/1999	1	100	0	Children
04/08/1999	1	200	2250000	Children
04/14/1999	2	0	0	Children
04/14/1999	1	0	0	Smoking
03/06/2000	2	500	201000	Children
04/10/2000	1	0	0	Children
11/01/2000	3	3000	0	Smoking
05/01/2001	7	0	0	Campfire
11/07/2001	1	2500	340000	Smoking
11/12/2001	4	300	305000	Children
11/12/2001	3	20300	2000	Miscellaneous
11/26/2001	3	500	0	Smoking
Totals	**111**	**$37,300**	**$6,515,500**	

Source: Virginia Department of Forestry, 2005.

Table 4.2.5f
Historic Hurricane Events – Stafford County

Storm Name	Date	Category	Total Est. Damage	Descriptions
Hazel	October 15, 1954	Hurricane	Unknown	▪ The Free-Lance Star reported flooding and property damage.
Connie	August 12, 1955	Hurricane	Unknown	▪ The Free-Lance Star reported flooding and property damage.
Diane	August 17, 1955	Hurricane	Unknown	▪ The Free-Lance Star reported flooding and property damage.
Camille	September 1960	Hurricane	Unknown	▪ The Free-Lance Star reported massive flooding.
Floyd	September 16, 1999	Tropical Storm	No estimate available.	▪ Gusty winds from 30 to 50 mph ▪ 16,000 power outages ▪ 5.97 inches in Spotsylvania
Isabel	September 18, 2003	Tropical Storm	$55.1 million – property $130,000 – crop	
Charley And Bonnie	August 18, 2004	Hurricane	Unknown	▪ Highest sustained wind was 73 mph ▪ Uprooted trees and downed numerous power lines ▪ Over 2 million Virginians without power ▪ Heavy rain and wind gust
Gaston	August 30, 2004	Tropical Depression	Unknown	▪ Hard rains that processed flooding ▪ Roads under water ▪ Power outage (99,600 statewide)
Frances	September 8, 2004	Hurricane	Unknown	
Ivan	September 17, 2004	Hurricane	Unknown	▪ Spawned unconfirmed tornadoes ▪ Power outage (66,000) Heavy rain/flooding
Jeanne	September 28, 2004	Hurricane	Unknown	▪ Flash flooding/heavy rainfall ▪ Power outage

Source: NOAA 2004, VWC 2004, and local emergency management.

Table 4.2.5g
Historic Tornado Events – Stafford County

Date	Magnitude	Property Damage ($)	Descriptions
February 18, 1960	F1	0K	
September 5, 1979	F1	250K	
July 24, 1999	F1	10K	▪ Parts of southern Stafford County lost power after downed trees fell onto power lines ▪ Most of the downed trees were in the Falmouth area.
July 10, 2003	F0	0K	▪ In Stafford County, an F0 tornado touched down approximately 5 miles southeast of Falmouth near Route 3. The tornado moved northeast and damaged trees until it lifted near Route 218 on the King George County line. The tornado was approximately 50 yards wide and was on the ground for 5 miles.
September 24, 2001	F0	0.1K	▪ At 4:00 p.m., the thunderstorm that produced the tornado near Sealston in King George County crossed into east Stafford County. A brief touch down occurred near Belle Plain. Minor tree damage was noted and later the same tornado briefly touched down near Aquia Bay Marina at the end of Aquia Creek Road, displacing three boats in dry dock. Damage was estimated at $10,000. ▪ At 4:18 p.m., an F0 tornado touched down in north Stafford County near Boswells Corner. Initially, the storm produced minor damage to trees, and siding and shingles were torn from a few homes. Minutes later, the storm produced extensive tree damage to the Crystal Lakes neighborhood. Damage was estimated at $50,000.
September 8, 2004	F0	10K	▪ The thunderstorm which produced the tornado near Sealston in King George County, continued into east Stafford County. A brief touch down occurred near Belle Plain (almost 4 miles NE of White Oak). Minor tree damage was noted and later the same tornado cycled and another brief touch down occurred near Aquia Bay Marina at the end of Aquia Creek Road (approximately 5 miles S of Aquia). Minor tree damage was noted there and 3 boats in dry dock were displaced. Power outage for several days.
September 17, 2004	F1	10K	▪ At 4:42 p.m., a tornado touched down in central Stafford County near Stones Corner. The storm tracked north-northeast and lifted near Stafford. The damage was limited to mature trees and large limbs. The tornado had a six-mile intermittent track, continuing into Prince William County. Damage was estimated at $10,000. ▪ Tree damage to homes. Wind damage to a trailer park in Wildwater/Boswells Corner area.

Source: NOAA 2004 and local emergency management; NA = Data not available.

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5.0 VULNERABILITY ASSESSMENT

The vulnerability assessment estimates the extent of injury and damages that may result from a hazard. Vulnerability can be quantified in those instances where there is a known, identified hazard area, such as a mapped floodplain. In such an instance the numbers and types of buildings subject to the identified hazard can be counted and their values tabulated. For those natural hazards not tied to a specific geographical location, such as severe weather, information is available where the potential impacts can be developed or inferred.

In the previous section, the HMPC identified eight natural hazards as critical, with medium to high hazard potential. These hazards affect either the RADCO region as a whole or have a specific geographical hazard area. The HMPC classified the hazards as follows:

Regional Vulnerability

- Drought; and
- Severe Weather, including
  - Northeasters;
  - Thunderstorms;
  - Tornadoes; and
  - Winter Storms.

Community Specific Vulnerability

- Flooding;
- Hurricanes; and
- Wildfire.

5.1 Regional Vulnerability Assessment

The two types of natural hazards that were classified by the HMPC as affecting the entire RADCO region were drought and severe weather. For these hazards, the potential impacts are presented below.

Drought

Drought impacts may include physical, bio-physical, social and economic consequences. Physically, there may be a reduction in water supply for drinking, domestic, and irrigation purposes with a subsequent impact of increased pumping costs. The ground water level may be depleted and the flow of perennial water sources reduced. Bio-physical impacts include damage to crop quantity and quality, damage to wildlife and habitat, an increase in invasive/noxious weeds, and the deterioration of water quality. Economically, there may be a loss in livestock production and increased prices for commodities.

Severe Weather
(Northeasters, Thunderstorms, Tornadoes, and Winter Storms)

The severe weather evaluated as part of this vulnerability assessment included: extreme temperatures, northeasters, thunderstorms, tornadoes, and winter storms. Impacts to the RADCO region as a result of severe weather could include damage to infrastructure, particularly damage to overhead power lines, road closures, and interruption in business and school activities. In the case of tornadoes, severe damages can occur to buildings. Utility outages can impact anything relying on electricity without a redundant power supply (e.g., a generator, solar power, or redistribution plan), and include secondary impacts such as interruption to water and sewage services, heat and refrigeration, fuel supplies, computers and cell phones. If interruption to business occurs for an extended period, economic impacts can be severe. Also of concern would be the impacts on populations with special needs such as the elderly and those requiring the use of electric medical equipment. Although typically short-lived, delays in emergency response services can also be of concern. Depending on the nature of a given storm, all

areas within the RADCO region are equally at risk; however, those areas relying on above ground utilities could suffer the greatest damage.

5.2 Community Specific Vulnerability Assessment

The HMPC identified three hazards to the RADCO region for which specific geographical hazard areas have been defined: flooding, hurricanes, and wildfires. Community vulnerability can be quantified in these instances where there is a known, identified hazard area. The numbers and types of buildings subject to the identified hazard can be counted and their values tabulated. Further, information may be collected on the location of critical community facilities (e.g., a fire station), historic structures, and valued natural resources (e.g., an identified wetland or endangered species habitat) that are within the specific hazard area. Together, these values portray the impact, or *vulnerability*, of that area to that hazard.

However, it is important to note that these values could be refined one step further, with regard to the percent of probable impact. For example, when a flood occurs, the event seldom causes the total destruction of an area. In fact, we know from NFIP insurance claims that a flood with an average depth of 2-feet above the ground is likely to cause approximately 20 percent damage to structures in the aggregate (those with basements, no basements, and second stories). Thus, if the 100-year flood were estimated to be 2-feet deep, a more accurate description of flood vulnerability would be a 1 percent annual chance of incurring a loss of 20 percent of the values tabulated in the 100-year floodplain, not including the additional impacts of damage to infrastructure and economic disruption. This allows a community to measure the cost-effectiveness of alternative mitigation projects under consideration. The benefits of a mitigation project are the future losses avoided, or in this example, that portion of the value of the 1 percent annual chance of 20 percent damage that is protected by the project.

In recent years, FEMA has developed a concept to highlight the impact that repetitively flooded structures have had on the NFIP. The term “repetitive loss,” as applied to the NFIP, refers to any property for which two or more flood insurance claims in excess of $1,000 each in a 10-year period of time have been paid. In 1998, FEMA reported that the NFIP's 75,000 repetitive loss properties have already cost $2.8 billion in flood insurance payments and numerous other flood prone properties continue to remain at high risk in the Nation's floodplains. While these properties make up only 1-2 percent of the flood insurance policies currently in force, they account for 40 percent of the Country's flood insurance claim payments. A report on repetitive loss structures completed by the National Wildlife Federation found that 20 percent of these structures are listed as being outside of the 100-year floodplain (Conrad et al. 1998).

For flooding, hurricane, and wildfire hazards, the HMPC has inventoried the following as a means of quantifying vulnerability:

- Development Trends within each jurisdiction;
- Critical Facilities;
- Community Impact; and
- Total Values at Risk (i.e., types, numbers, and value of land and improvements).

Sections 5.2.1 through 5.2.5 present the vulnerability assessment of each community within the RADCO region to the hazards of flooding, hurricanes, and wildfires.

5.2.1 Caroline County, including the Town of Bowling Green and the Town of Port Royal Vulnerability Assessment

Development Trends

The Caroline County Department of Economic Development promotes the goals of business recruitment, job creation, business retention, and marketing in the County. Caroline has a labor population of 11,530 and an unemployment rate of 4%. Commercial investment has been successful through the recruitment of the CFC Farmers Market and the move of the Virginia State Fair from Richmond to Caroline.

The Caroline County Strategic Plan promotes education with an increased emphasis on school-to-work, alternative education, and workforce training programs. Over half (51.4%) of Caroline County's workforce consists of management, professional, sales, and office professions. According to the Strategic Plan, "Caroline County will maintain, expand and diversify its economic base by working with existing industries, attracting new industries, promoting tourism, and improving its commercial and retail base in order to provide a wider range of employment, income and services for County residents."

Caroline County's population increased from 19,217 in 1990 to 22,121 in 2000 (15.1% increase). As of July 2005, the city projects a population of 25,099 for 2010, which will be a 13.5% increase from 2000 (Caroline County, Virginia, 2005, compiled by AMEC).

Critical Facilities

In order to assess the vulnerability of a community to natural hazards, the HMPC and the consulting team conducted an inventory of the residential and non-residential structures within Caroline County and identified critical facilities (Table 5.2.1a). The critical facilities are the community's assets that are the most important or vital to emergency management functions. Critical facilities include:

- Emergency Operation Center (EOC);
- Emergency Communications Center (ECC) / 911;
- Law Enforcement Offices;
- Fire / Rescue Stations;
- Emergency Medical Services (EMS);
- Power;
- Communications;
- Water;
- Wastewater Treatment Plants (WWTP);
- Shelters; and
- Administration Buildings / Courthouse.

Critical facilities are those facilities that warrant special attention in preparing for a disaster and/or facilities that are of vital importance to maintaining citizen life, health, and safety during and/or directly after a disaster event. HMPC member representatives from Caroline County provided the inventory of critical facilities for the county.

Town of Bowling Green

HMPC member representatives from Caroline County provided the inventory of critical facilities for the Town of Bowling Green. The listing of critical facilities includes emergency response facilities and public facilities (Table 5.2.1b).

Town of Port Royal

HMPC member representatives from Caroline County provided the inventory of critical facilities for the Town of Port Royal. The listing of critical facilities is listed in Table 5.2.1c.

Table 5.2.1a
Critical Facilities – Caroline County

Facility Name	Street	Location	Facility Type
Dept Fire & Rescue Admin. Emergency Operations Center	17202 Richmond Turnpike	Caroline County	Fire-Rescue Admin/EOC
Upper Caroline Fire Dept[1]	12581 Stonewall Jackson Rd	Woodford	Fire Dept
Frog Level VFD.[2]	30240 Richmond Turnpike	Hanover	Fire Dept
Ladysmith VFD.[2]	17420 Jefferson Davis Hwy	Ladysmith	Fire Dept
Sparta VFD.[2]	23280 Sparta Rd	Sparta	Fire Dept
Port Royal VFD.[2]	435 King Street	Port Royal	Fire Dept
Frog Level VRS	29415 Richmond Turnpike	Ruther Glen	Rescue Squad
Ladysmith VRS	18287 Jefferson Davis Hwy	Ladysmith	Rescue Squad
Rappahannock Elec. Field Ofc.	14380 Fredericksburg Turnpike	Caroline County	Power Co. local office
St. Johns Sub-Station	Rt. 725 & 639 five miles east of I-95	Ruther Glen	Electrical Sub Station
Communications Transmit Tower	Varies	Varies	Communications
Communications Receive Towers	Varies	Varies	Communications
WWUZ CH 245[1]	Penola Rd.		Communications
Cell & Microwave Towers	Varies	Varies	Communications
Caroline Co. STP	22101 Rogers Clark Blvd	Ruther Glen	Wastewater
Ladysmith Primary[2]	9075 Chance Place	Ruther Glen	School / Shelter
Bowling Green Primary[2]	17176 Richmond Turnpike	Milford	School / Shelter
Bowling Green Elem	16261 Richmond Turnpike	Caroline County	School / Shelter
Ladysmith Elem[2]	7278 Ladysmith Rd	Ruther Glen	School / Shelter
Caroline Middle[2]	13325 Devils Three Jump Rd	Milford	School / Shelter
Caroline High School	19155 Rogers Clark Blvd	Milford	School / Shelter
Caroline County Courthouse	Main Street and Court House Lane	Bowling Green	Administration Building
Additional significant structures			
CSX/Amtrak Railway	Varies	Varies	Transportation
Plantation gas Pipeline	Varies	Varies	Gas
Columbia Gas Pipeline	Varies	Varies	Gas
School Board Office	16221 Richmond Turnpike	Caroline County	School Board
Pneumansend Regional Jail	11093 S.W. Lewis Memorial Dr.	Caroline County	Jail

Table 5.2.1a
Critical Facilities – Caroline County

Facility Name	Street	Location	Facility Type
Lake Caroline Dam	75 Saratoga Cove	Ruther Glen	Office
Lake Land'or Dam	319 Land'or Drive	Ruther Glen	Office

[1] Data taken from FEMA HAZUS-MH program
[2] Data provided by RADCO
Source: HAZUS and RADCO. Assembled by AMEC.

Table 5.2.1b
Critical Facilities – Town of Bowling Green

Facility Name	Street	Town	Facility Type
State Police	101 Ennis St.	Bowling Green	Police Departments
Caroline Sheriff Admin.	118 Courthouse Ln.	Bowling Green	Police Departments
Bowling Green Police Dept	117 Butler St.	Bowling Green	Police Departments
Bowling Green Fire Dept	130 Courthouse Ln.	Bowling Green	Fire Dept
911 Center	108B Courthouse Ln.	Bowling Green	911 Center
Bowling Green Rescue Squad[1]	132 Courthouse Ln.	Bowling Green	Rescue Squad
Water Main Controls/Ground Storage Well	107 Butler St.	Bowling Green	Water
Fort AP Hill	Route 301 & State Route 608	Bowling Green	Wastewater
Wastewater Treatment Plant	219 Anderson Ave.	Bowling Green	Wastewater
Sewer Pump Station	104 Lacy Lane	Bowling Green	Sewer
Sewer Pump Station	16356 Heritage Pines Circle	Bowling Green	Sewer
Town Hall	117 Butler Street	Bowling Green	Administration Building
Additional significant structures			
Dialysis Center	102 W. Broaddus Ave.	Bowling Green	Medical
Nursing Home	116 Anderson Ave.	Bowling Green	Medical

Source: Data provided by the Town of Bowling Green. Assembled by AMEC.

Table 5.2.1c
Critical Facilities – Town of Port Royal

Facility Name	Street	Town	Facility Type
Port Royal V.F.D. [1]	435 King Street	Port Royal	Fire Dept
Town Water Storage Tank	435 King Street	Port Royal	Water
Town Hall	419 King Street	Port Royal	Administration

[1] Data provided by RADCO
Source: Data provided by the Town of Port Royal. Assembled by AMEC.

Flooding Vulnerability

RADCO staff, in conjunction with AMEC, developed the flood vulnerability analysis for Caroline County. The existing FEMA FIRMs were used in conjunction with hardcopy tax parcel mapping provided by Caroline County. The 100-year flood boundaries were transposed to the tax maps and the number of parcels intersecting the 100-year flood boundary were counted. The current values of the improvements from the County Tax Assessor database were used to determine the estimated at-risk value. The values used in this analysis represent the Assessor's value for improvements on the parcels identified. The analysis performed does not specifically identify structures or content value in flood prone area, but rather associates all structures identified on parcels that intersected the 100-year FIRM boundary, and as such, the value represents a conservative estimate of potential flooding risk.

The Caroline County Tax Assessor's database identified 22,998 parcels with a total improvement value (structure only, not land value) of $1,208,331,200. The vulnerability analysis determined that 2,226 parcels (approximately 10%) intersect the 100-year floodplain as delineated on the August 15, 1989 FEMA FIRMs. This results in an at-risk value of $103,642,400. Segregated data for occupancy type was not available.

Table 5.2.1d
Flood Risk – Caroline County

Total No. Parcels	No. Parcels in 100-year Flood Zone	Estimated at Risk Structure Value
22,998	2,226	$103,642,400

Source: Data provided by community, compiled by AMEC

A regional map of the 100-year floodplains and the jurisdictions' critical facilities is provided in Appendix B, Map B-5.

Repetitive Loss Areas

Including flood insurance claims paid as a result of flood damage caused by Hurricane Isabel in 2003, FEMA has not identified any structures as repetitive loss structures for Caroline County. FEMA has not identified any flood hazards within the Town of Bowling Green corporate limits, and as such, there are no repetitive flood loss areas. The Town of Port Royal has a FEMA published FIRM map but is currently not participating in the NFIP. No additional flooding data was available at the time this plan was drafted.

Hurricane Vulnerability

Hazards U.S. – Multi Hazard (HAZUS®MH) was utilized to perform a wind hazard analysis for Caroline County. HAZUS®MH software is a multi-hazard loss estimation program that was developed under a cooperative agreement between the National Institute of Building Sciences and FEMA. The current version of HAZUS®MH has the ability to calculate earthquake, wind, and flood hazards as well as potential economic losses associated with these hazards. The software is designed with the flexibility to perform loss estimations at three different levels. Level 1 utilizes all default parameters built into the software. Levels 2 and 3 require user defined scenarios and building inventory data. For the purpose of this Plan, a Level 1 wind analysis was performed to calculate the wind hazard for Caroline County. Table 5.2.1e lists the total dollar value of exposed structures based on occupancy type for Caroline County.

The default data set provided with the HAZUS®MH software is based on the 2000 census data. It is recognized that the current development trends in Caroline County may render the 2000 census data, with which HAZUS®MH is programmed, somewhat obsolete. However, this analysis depicts the probability of occurrence and can generally be used to estimate potential damages due to high winds.

Table 5.2.1e
Total Dollar Value of Exposed Structures from HAZUS®MH – Caroline County

Occupancy Type	Total $ Value Exposed Structures
Residential	1,069,417,000
Commercial	59,405,000
Industrial	6,830,000
Agricultural	2,147,000
Religion	14,336,000
Government	3,150,000
Education	1,504,000
Total	**1,156,789,000**

Source: HAZUS

The two options provided by HAZUS®MH software for wind analysis are the probabilistic and deterministic methods. The probabilistic scenario is the default option for the software and activates a database of many thousands of storm tracks and intensities. This scenario generates hurricane hazards based on set return periods. These return periods define the statistical probability that a storm of a given size and intensity could occur within any year. The deterministic method analyzes hazards associated with a user defined storm event. The user inputs the storm track, forward speed, and wind speed and allows for the creation of "what-if" scenarios.

The probabilistic wind analysis was chosen because it provides the statistical probability for a range of hurricane events and presents a comparison of these events. The probabilistic analysis was used to generate structural loss estimations for hurricane events with specific recurrence intervals; 10-, 20-, 50-, 100-, 200-, 500-, and 1000-year. The recurrence interval is the average interval of time within which the given hurricane event will be equaled or exceeded once.

Because residential structures comprise a significantly large percentage of the occupancy classification within Caroline County, these data are presented in Table 5.2.1f below. Figure 5.2.1 shows the peak wind gusts, ranging from 61mph to 69mph, generated from a hurricane with a 100-year recurrence interval.

Table 5.2.1f
Hurricane Risk - Caroline County
Summary of Probabilistic Analysis – Residential Structures

Return Period	Residential Building Damage			
	Minor Damage	Moderate Damage	Severe Damage	Total Destruction
10-year	0	0	0	0
20-year	1	0	0	0
50-year	5	0	0	0
100-year	95	2	0	0
200-year	296	14	1	0
500-year	1,691	294	18	14
1000-year	2,307	599	66	56

Source: HAZUS

Wildfire Vulnerability

Caroline County provided hardcopy tax parcel information dated at a scale of 1"=600'. RADCO provided a land use suite of layers that delineated the agricultural preservation area and the boundary of Fort A.P. Hill. The agricultural preservation area is defined in the Caroline County Comprehensive Plan as lands designated for agricultural uses and residential densities, and are not to exceed a ratio of one structure per 25 acres. Since these areas contain very low population densities, these areas were removed from the wildfire analysis. The area covered by Fort A.P. Hill was also excluded from the analysis because it is under the jurisdiction of the United States Army. The VDOF Wildfire mapping for Caroline County was plotted at the same scale as the Caroline County Tax Parcel mapping for all areas not previously indicated and those parcels that intersect the high wildfire hazard boundary were totaled.

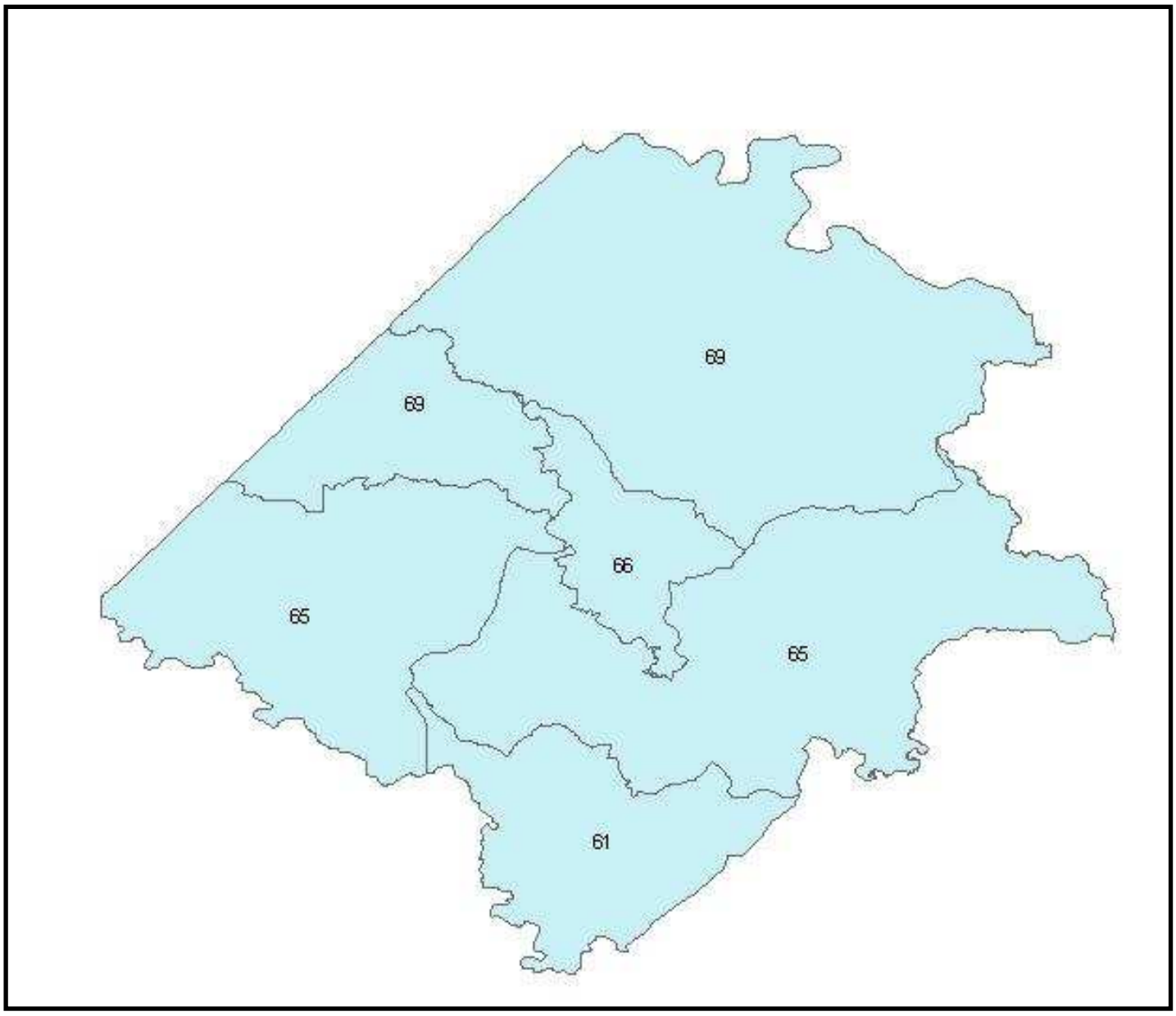
The analysis yielded approximately 11,759 parcels that intersected the high wildfire hazard boundary as delineated by VDOF. The improvement value for these parcels was totaled and resulted in an at risk value of $589,321,400 for Caroline County.

Table 5.2.1g
Wildfire Risk – Caroline County

Total No. Parcels	No. Parcels in High Wildfire Zone	Estimated at Risk Value
22,998	11,759	$589,321,400

Source: Data provided by Caroline County and compiled by AMEC

Figure 5.2.1
Peak Wind Gust (mph) Distribution (100-year) Caroline County
(Source: HAZUS)



5.2.2 City of Fredericksburg Vulnerability Assessment

Development Trends

The City of Fredericksburg's business development relies heavily upon tourism. The City's Tourism and Business Development Department considers its primary function to be the promotion of tourism to assist development of the local travel industry. As of September 30, 2004, 13,560 jobs were held in the service industry and 4,440 jobs were held in the trade industry. Out of 25,187 employment positions in Fredericksburg, these sectors accounted for 53.8% and 17.8%, respectively (a total of 71.6% of Fredericksburg jobs).

Service-related businesses (food and hotel/motel) made up 20.5% of taxable sales in 2004 with $215,720,808 of Fredericksburg's total of $1,047,573,565 in taxable sales. The largest identifiable business group was the food industry, which had 235 dealers and $199,427,478 in sales during 2004. Sixteen hotel/motel businesses accounted for $16,293,330.

Fredericksburg's population increased from 19,027 in 1990 to 19,279 in 2000 (1.3% increase). As of July 2005, the city projects a population of 24,703 for 2010, which will be a 28.1% increase from 2000 (City of Fredericksburg, Virginia, 2005, compiled by AMEC).

Critical Facilities

In order to assess the vulnerability of a community to natural hazards, the HMPC conducted an inventory of the structures and critical facilities within the City of Fredericksburg (Table 5.2.2a). The critical facilities are the community's assets that are the most important or vital to emergency management functions. Critical facilities include:

- Emergency Operation Center (EOC);
- Emergency Communications Center (ECC) / 911;
- Law Enforcement Offices;
- Fire / Rescue Stations;
- Emergency Medical Services (EMS);
- Power;
- Communications;
- Water;
- Wastewater Treatment Plants (WWTP);
- Shelters; and
- Administration Buildings / Courthouse.

Critical facilities are those facilities that warrant special attention in preparing for a disaster and/or facilities that are of vital importance to maintaining citizen life, health, and safety during and/or directly after a disaster event. HMPC member representatives from the City of Fredericksburg provided the inventory of critical facilities for the county.

Table 5.2.2a
Critical Facilities – City of Fredericksburg

Facility Name	Street	City	Facility Type
Emergency Operation Center Fredericksburg Fire Dept. Station 2	101 Altoona Dr	Fredericksburg	EOC
Executive Plaza Office Building	601 Caroline St.	Fredericksburg	Police and Fire
Fredericksburg Police Narcotic	601 Caroline St.	Fredericksburg	Police Departments
Fredericksburg Police Hdqrs	615 Princess Anne St.	Fredericksburg	Police Departments
Fredericksburg Sheriff	415 Wolfe St.	Fredericksburg	Police Departments
Fredericksburg Fire Dept Station 2	101 Altoona Dr.	Fredericksburg	Fire Dept
Fredericksburg Rescue Squad	510 William St.	Fredericksburg	Fire Dept
Fredericksburg Fire Inspection Station 1	601 Princess Anne St.	Fredericksburg	Fire Dept
E-911 Center	615 Princes Anne St	Fredericksburg	Communications
Verizon	901 Prince Edward St	Fredericksburg	Communications
Powhatan Site Police #2 Fire and Rescue #1	1500 block Powhatan St	Fredericksburg	Radio Repeater
Ashby Street Site Police #1	1 Learning Lane	Fredericksburg	Radio Repeater
Courtland Water Pumping Station	Ashby Street	Fredericksburg	Water Pumping Station
Powhatan Water Pumping Station	Powhatan St and Cowan Blvd	Fredericksburg	Water Pumping Station
Lafayette Blvd Pumping Station	Central Rd and Lafayette Blvd	Fredericksburg	Water Pumping Station
Motts Run Reservoir Water Treatment Plant	13000 Trench Hill Lane	Fredericksburg	Water Treatment Plant
Normandy Village Sewage Pump Station	Fall Hill and Village Ln	Fredericksburg	Sewage Pump Station
Bragg Hill Sewage Pump Station	Roffman Road	Fredericksburg	Sewage Pump Station
Rts 2 and17 Area Sewage Pump Station	Dixon and Lansdowne Rd	Fredericksburg	Sewage Pump Station
Snowden Sewage Pump Station	Mary Washington Blvd and Jefferson Davis Hwy	Fredericksburg	Sewage Pump Station
Caroline Street Sewage Pumping Station	Caroline and Ford Street	Fredericksburg	Sewage Pumping Station
Fall Hill Sewage Pumping Station	Cowan Blvd	Fredericksburg	Sewage Pumping Station
City of Fredericksburg Wastewater Treatment	700 Beulah Salisbury Rd.	Fredericksburg	Wastewater Treatment Plant
Hugh Mercer Elementary	2100 Cowan Blvd.	Fredericksburg	School / Shelter
James Monroe High	2300 Washington Ave.	Fredericksburg	School / Shelter
Walker-Grant Middle	One Learning Ln.	Fredericksburg	School / Shelter
City Hall	715 Princess Anne Street	Fredericksburg	Administration

Table 5.2.2a
Critical Facilities – City of Fredericksburg

Facility Name	Street	City	Facility Type
Additional significant structures			
Mary Washington Hospital	1001 Sam Perry Blvd.	Fredericksburg	Hospital
National Guard Army	1700 Jefferson Davis Highway	Fredericksburg	Military
FBI Field Office (local)	Jefferson Davis Highway	Fredericksburg	Federal Government

Source: Data provided by Fredericksburg Emergency Services Coordinator. Assembled by AMEC.

Flooding Vulnerability

The flood information for the City was determined by overlaying the City's tax maps with the City's FIRM, dated January 1979. Floodplains from the FEMA FIRM were delineated on the Fredericksburg tax maps by relative comparison. Any tax parcel that intersected the delineated floodplain was considered as inside the floodplain and its building improvement value was added to the total property value in the 100-year floodplain. Parcels within the 100-Year flood zone that did not have building improvement values were assumed to have no structures. Thus, from a total of 7,038 parcels, 5,837 were assumed to have structures.

Results of the aforementioned flood analysis are given in Table 5.2.2b.

Table 5.2.2b
Flood Risk – City of Fredericksburg

Occupancy Type	Total No. Buildings	No. Buildings in 100-year Flood Zone	Estimated at Risk Value
Residential	4,437	75	16.1 million
Non-Residential	1,400	185	44.2 million
TOTAL	5,837	260	60.3 million

Source: Data provided by community compiled by AMEC

A regional map of the 100-year floodplains and the jurisdictions' critical facilities is provided in Appendix B, Map B-5. In Fredericksburg, there are two law enforcement offices located in the floodplain. One is an office of Police Records and the other is a Police Narcotics office.

Repetitive Loss Areas

Including flood insurance claims paid as a result of flood damage caused by Hurricane Isabel in 2003, FEMA has identified four structures as repetitive loss structures in the City of Fredericksburg.

Hurricane Vulnerability

Hazards U.S. – Multi Hazard (HAZUS-MH) was utilized to perform a wind hazard analysis for the City of Fredericksburg. HAZUS®*MH* software is a multi-hazard loss estimation program that was developed under a cooperative agreement between the National Institute of Building Sciences and FEMA. The current version of HAZUS®*MH* has the ability to calculate earthquake, wind, and flood hazards as well as potential economic losses associated with these hazards. The software is designed with the flexibility to perform loss estimations at three different levels. Level 1 utilizes all default parameters built into the software. Levels 2 and 3 require user defined scenarios and building inventory data. For the purpose of this Plan, a Level 1 wind analysis was performed to calculate the wind hazard for City of Fredericksburg. Table 5.2.2c lists the total dollar value of exposed structures within the City based on occupancy type.

The default data set provided with the HAZUS-MH software is based on the 2000 census data. It is recognized that the current development trends in the RADCO region make the 2000 census data obsolete. However, this analysis depicts the probability of occurrence and can generally be used to estimate potential damages due to high winds.

Table 5.2.2c
Total Dollar Value of Exposed Structures from HAZUS®*MH* –City of Fredericksburg

Occupancy Type	Total $ Value Exposed Structures
Residential	1,113,819,000
Commercial	407,459,000
Industrial	21,365,000
Agricultural	1,439,000
Religion	16,152,000
Government	4,694,000
Education	5,515,000
Total	**1,570,443,000**

Source: HAZUS

HAZUS®*MH* software provides two options for wind analysis, probabilistic and deterministic. The probabilistic scenario is the default option for the software and activates a database of many thousands of storm tracks and intensities. This scenario generates hurricane hazards based on set return periods. These return periods define the statistical probability that a storm of a given size and intensity could occur within any year. The deterministic method analyzes hazards associated with a user defined storm event. The user inputs the storm track, forward speed, and wind speed and allows for the creation of "what-if" scenarios.

The probabilistic wind analysis was chosen because it provides the statistical probability for a range of hurricane events and presents a comparison of these events. The probabilistic analysis was used to generate structural loss estimations for hurricane events with specific recurrence intervals; 10-, 20-, 50-, 100-, 200-, 500-, and 1000-year. The recurrence interval is the average interval of time within which the given hurricane event will be equaled or exceeded once.

Since "residential" comprised a significantly large percentage of the occupancy classification these data are presented in Table 5.2.2d below. Figure 5.2.2 shows the peak wind gusts, ranging from 83mph to 85mph, generated from a hurricane with 100-year recurrence interval.

Table 5.2.2d
Hurricane Risk - City of Fredericksburg
Summary of Probabilistic Analysis – Residential Structures

Return Period	Residential Building Damage			
	Minor Damage	Moderate Damage	Severe Damage	Total Destruction
10-year	0	0	0	0
20-year	7	0	0	0
50-year	53	4	0	0
100-year	246	28	2	0
200-year	342	44	2	0
500-year	1,252	388	21	10
1000-year	1,589	704	55	30

Source: HAZUS

Wildfire Vulnerability

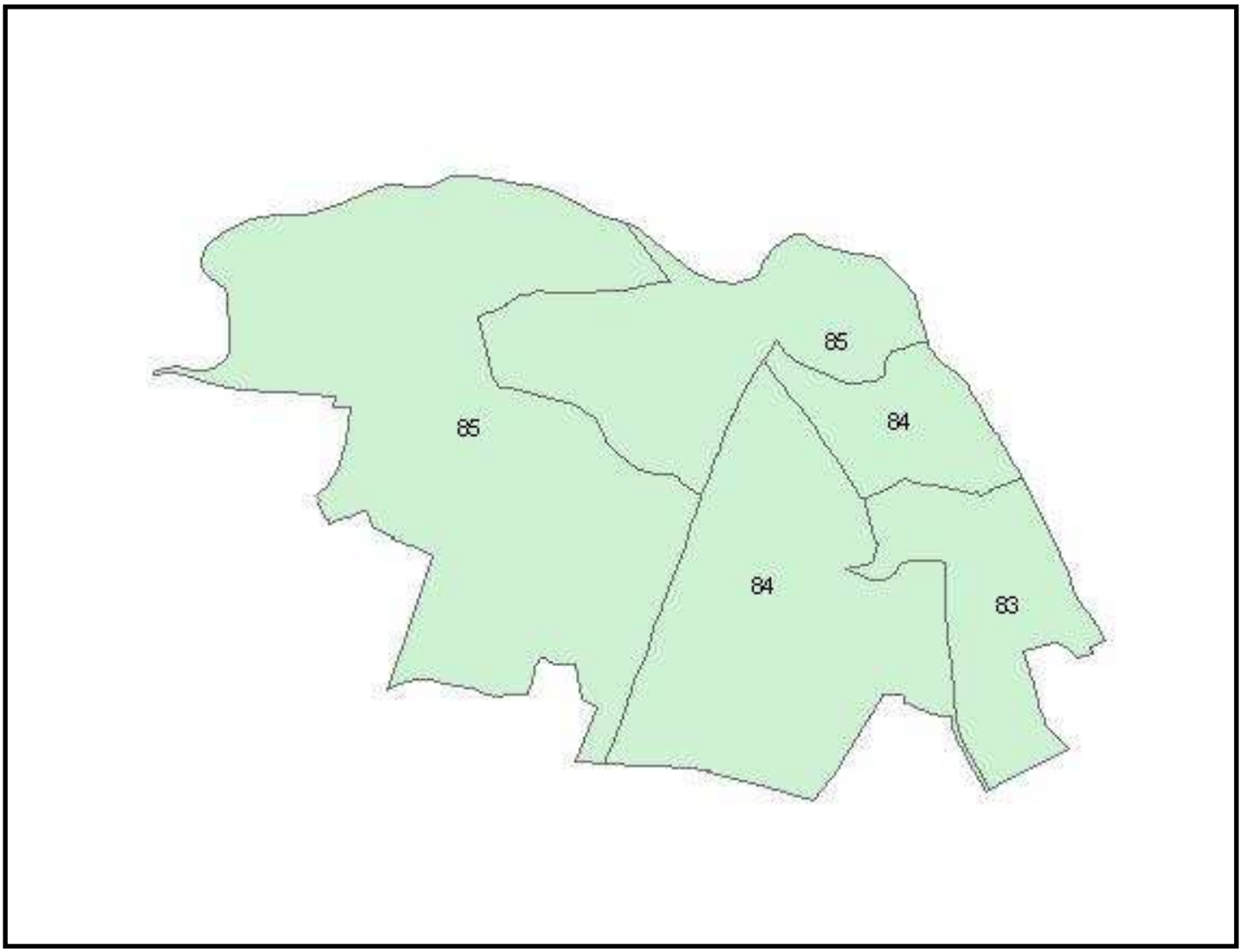
The Wildfire Risk Assessment data, provided by the Virginia Department of Forestry, was utilized to estimate the wildfire risk for City of Fredericksburg. This data layer was overlaid with the City tax parcel mapping in order to estimate the value of at risk structures. The VDOF also provided the number of wildfire incidents reported from 1995-2001. The table below breaks out the City of Fredericksburg's risk to wildfire (Table 5.2.2e).

Table 5.2.2e
Wildfire Risk – City of Fredericksburg

Total No. Buildings	No. Buildings in High Wildfire Zone	Estimated at Risk Value
5,837	226	$69.1 million

Source: Data provided by the City of Fredericksburg, VA and compiled by AMEC

Figure 5.2.2
Peak Wind Gust (mph) Distribution (100-year)
City of Fredericksburg
(Source: HAZUS)



5.2.3 King George County Vulnerability Assessment

Development Trends

The King George County Comprehensive Plan promotes the goals of business recruitment, job creation, business retention, and marketing in King George County. The second listed commercial implementation strategy of the Plan's Land Use Strategy is to "encourage the creation of an environment to attract businesses and employees for the public and private sectors." King George County has a labor population of 9,190 and an unemployment rate of 2.9%. The local Business Appreciation Event, held last May 20, 2005, is used as a tool to attract and retain businesses to King George County. The county's largest employers are U.S. Naval Surface Warfare Center at Dahlgren and Rowe Concrete, LLC. Other large employers include Computer Sciences Corporation and Synetics, Inc. (Source: Virginia Economic Development Partnership).

Over half (61.2%) of King George County's workforce consists of management, professional, sales, and office professions. King George County's population increased from 13,527 in 1990 to 16,803 in 2000 (24.2% increase). As of July 2005, the County projects a population of 22,000 for 2010, which will be a 30.9% increase from 2000 (King George County, Virginia, 2005, compiled by AMEC).

Critical Facilities

In order to assess the vulnerability of a community to natural hazards, the HMPC conducted an inventory of the structures and critical facilities within King George County (Table 5.2.3a). The critical facilities are the community's assets that are the most important or vital to emergency management functions. Critical facilities include:

- Emergency Operation Center (EOC);
- Emergency Communications Center (ECC) / 911;
- Law Enforcement Offices;
- Fire / Rescue Stations;
- Emergency Medical Services (EMS);
- Power;
- Communications;
- Water;
- Wastewater Treatment Plants (WWTP);
- Shelters; and
- Administration Buildings / Courthouse.

Critical facilities are those facilities that warrant special attention in preparing for a disaster and/or facilities that are of vital importance to maintaining citizen life, health, and safety during and/or directly after a disaster event. HMPC member representatives from King George County provided the inventory of critical facilities for the County.

Table 5.2.3a
Critical Facilities – King George County

Facility Name	Street	Location	Facility Type
King Georges Sheriff's Office	9483 Kings Highway	King George	EOC
King George Fire & Rescue Inc. Company 1	8122 Kings Highway	King George	Fire Department
King George Fire & Rescue Inc. Company 2	16147 Dahlgren Road	King George	Fire Department
King George Fire & Rescue Inc. Company 3	6060 Riverview Drive	King George	Fire Department
Dahlgren Rescue Squad Inc. Station 1	8086 Kings Highway	King George	Rescue Station
Dahlgren Rescue Squad Inc. Station 2	16037 Dahlgren Road	King George	Rescue Station
EMS Tower	8562 Dahlgren Road. Behind King George Middle School	King George	Communications Tower
Owens Tower	Dahlgren Road – Intersection of Dahlgren Rd. and Owens Drive. West of 15049 Dahlgren Rd	King George	Communications Tower
Sheriff's Office Tower	9483 Kings Highway – King George Courthouse Complex	King George	Communications Tower
Accurate Tower	6269 Caledon Road – Located at Accurate Auto Parts	King George	Communications Tower
Arnolds Corner Storage Tank	8085 Kings Highway	King George	Water Tanks/Wells
Arnolds Corner Well	10087 Arnolds Court	King George	Water Tanks/Wells
Bayberry Well	4411 Chesapeake Place	King George	Water Tanks/Wells
Bumbrey Well	5178 James Madison Parkway	King George	Water Tanks/Wells
Canterbury #1 Well	12364 Kent Road	King George	Water Tanks/Wells
Canterbury #2 Well	12256 Canterbury Court	King George	Water Tanks/Wells
Circle #1 Well	11065 Carleton Drive	King George	Water Tanks/Wells
Circle #2 Well	11060 Vernon Woods Drive	King George	Water Tanks/Wells
Fairview #2 Well	6240 Fairview Drive	King George	Water Tanks/Wells
Fairview #3 Well	6131 11th Street	King George	Water Tanks/Wells
Monmouth 1st Well	16963 Village Lane	King George	Water Tanks/Wells
Monmouth 2nd Well/Water Tower	16960 Village Lane	King George	Water Tanks/Wells
Ninde Store Well	16197 Ridge Road	King George	Water Tanks/Wells
Oakland Park Well	1294 Forest Ridge Road	King George	Water Tanks/Wells
Oakland Park Well (Old)	1311 Oakland Drive	King George	Water Tanks/Wells
Owens Well	15093 Owens Drive	King George	Water Tanks/Wells
Peppermill #1 Well	7186 Stuart Road	King George	Water Tanks/Wells
Peppermill #2 Well	12228 Cleydael Boulevard	King George	Water Tanks/Wells
Potomac Landing Well	6153 Potomac Landing Drive	King George	Water Tanks/Wells
Presidential Lakes Well	10263 Madison Drive	King George	Water Tanks/Wells
Rose Dale Water Tower	6052 Rose Dale Drive	King George	Water Tanks/Wells
Purkins Corner Well	10379 Ridge Road	King George	Water Tanks/Wells
St Paul's Church Well	5371 Strawberry Lane	King George	Water Tanks/Wells
Payne Well	End of Payne Drive	King George	Water Tanks/Wells
10th Street Pump Station	17024 10t St	King George	Sewage Pump Station
12th Street Pump Station	17145 12th St	King George	Sewage Pump Station
Bayberry Pump Station	15596 Cape Fear Lane	King George	Sewage Pump

Table 5.2.3a
Critical Facilities – King George County

Facility Name	Street	Location	Facility Type
			Station
Comfort Inn Pump Station	4661 James Madison Parkway	King George	Sewage Pump Station
Fas Mart Pump station	8181 Kings Highway	King George	Sewage Pump Station
Fairview Beach 8th Street Pump Stations	6155 Eight Street	King George	Sewage Pump Station
Fairview Beach Crab House Pump Station	6129 Fairview Drive	King George	Sewage Pump Station
Fairview Beach Marina Grinder Pump	6338 Riverview Drive	King George	Sewage Pump Station
Fairview Beach Slick's Grinder Pump	6088 Sixth Street	King George	Sewage Pump Station
Ferry Dock Pump Station	17161 Ferry Dock Road	King George	Sewage Pump Station
Food Lion/Purkins #3 Pump Stations	9063 Kings Highway	King George	Sewage Pump Station
Gordon Drive Pump Stations	5405 Gordon Drive	King George	Sewage Pump Station
Kings Highway/Purkins Pump Station #1	10479 Kings Highway	King George	Sewage Pump Station
Main Pump Station	16389 Dahlgren Road	King George	Sewage Pump Station
McDonalds Pump Station	5265 James Madison Parkway	King George	Sewage Pump Station
Middle School Pump Station	8562 Dahlgren Road	King George	Sewage Pump Station
Monmouth Pump Station	16960 Village Place	King George	Sewage Pump Station
Oakland Park Pump Station	1015 French Court	King George	Sewage Pump Station
Potomac Landing Pump Station	6153 Potomac Landing Drive	King George	Sewage Pump Station
Pump Station #5	5006 Potomac Drive	King George	Sewage Pump Station
Pump Station #6	4292 Potomac Drive	King George	Sewage Pump Station
Purkins Pump Stations #2 RR3-HSL	9062 Kings Highway	King George	Sewage Pump Station
Williams Creek Pump Station	16276 Dahlgren Road	King George	Sewage Pump Station
Dahlgren WWTP	16383 Dahlgren Road	King George	Sewer Treatment Facilities/Water Treatment Facilities
Fairview Beach WWTP	6268 Riverview Drive	King George	Sewer Treatment Facilities/Water Treatment Facilities
Oakland Park WWTP	1015 French Court	King George	Sewer Treatment Facilities/Water Treatment Facilities
Purkins Corner WWTP/Auto Dialer	11224 Henry Griffin Road	King George	Sewer Treatment Facilities/Water Treatment Facilities

Table 5.2.3a
Critical Facilities – King George County

Facility Name	Street	Location	Facility Type
Presidential Lakes WWTP	9475 Inaugural Drive	King George	Sewer Treatment Facilities/Water Treatment Facilities
King George High School	8246 Dahlgren Road	King George	Schools/Shelter Sites
King George Middle School	8562 Dahlgren Road	King George	Schools/Shelter Sites
King George Elementary School	10381 Ridge Road	King George	Schools/Shelter Sites
Potomac Elementary School	16495 Fifteenth Street	King George	Schools/Shelter Sites
King George Recreation Center			
Sealston Elementary	11048 Fletchers Chapel Road	King George	Schools/Shelter Sites
Administration Center	10459 Courthouse Drive	King George	Administration
King George Courthouse Complex	9483 Kings Highway	King George	Administration
Potomac Gateway Welcome Center	3450 James Madison Parkway	King George	Administration
Additional significant structures			
VDOT Edgehill Area Maintenance Headquarters	12379 State Road	King George	VDOT Maintenance Building
King George County School Bus Garage	10350 Millbank Road	King George	School Owned Fuel Station
Harry Nice Memorial Bridge	James Madison Parkway (Rt 301), North end of County at Maryland State Line. North of 3540 James Madison Parkway	King George	Bridge
Rappahannock River Bridge	James Madison Parkway (Rt 301), South end of County at King George/Caroline County line. South of 17062 James Madison Parkway	King George	Bridge
Williams Creek Bridge	East of 16278 Dahlgren Road	King George	Bridge
Muddy Creek Bridge	Kings Highway and Stafford County Line	King George	Bridge
Machadoc Creek Bridge	Windsor Drive / East of 16314 Windsor Drive	King George	Bridge
Machadoc Creek Bridge	James Madison Parkway / Between 6186 and 6323 James Madison Parkway	King George	Bridge

Source: Data provided by the King George Office of Emergency Management. Assembled by AMEC.

Flooding Vulnerability

The HMPC representatives for King George County did not rank flooding as a critical hazard. However, because there is a defined geographic hazard area, vulnerability to flooding was quantified.

Digital floodplain boundaries digitized from the FEMA effective FIRMs and digital tax parcel data were provided by the King George County GIS Department. These two layers were intersected to determine the number of parcels that were at risk to the 100-year flood. Parcels within the 100-Year flood zone that did not have building valuation data in the tax parcel data were assumed to have no structures. Thus, from a total of 10,967 parcels, 6,226 were assumed to have structures.

The analysis showed that 704 buildings were at risk from the 100-yr flood. The improvement value (structure only, not land value) from the tax assessor's database was used to determine the value of at risk property. A total value of approximately $123,825,500 is at risk from the 100-year flood event. Results of this flood analysis are presented in Table 5.2.2b.

Table 5.2.3b
Flood Risk –King George County

Occupancy Type	Total No. Buildings	No. Buildings in 100-year Flood Zone	Estimated at Risk Value
Residential	1,933	133	30.4 million
Agricultural	3,884	547	82.4 million
Commercial	396	24	11.0 million
Other	13	0	0
TOTAL	6,226	704	123.8 million

Source: Data provided by community compiled by AMEC

A regional map of the 100-year floodplains and the jurisdictions' critical facilities is provided in Appendix B, Map B-5.

Repetitive Loss Areas

Including flood insurance claims paid as a result of flood damage caused by Hurricane Isabel in 2003, FEMA has identified zero structures as repetitive loss structures for King George County.

Hurricane Vulnerability

Hazards U.S. – Multi Hazard (HAZUS-MH) was utilized to perform a wind hazard analysis for King George County. HAZUS®*MH* software is a multi-hazard loss estimation program that was developed under a cooperative agreement between the National Institute of Building Sciences and FEMA. The current version of HAZUS®*MH* has the ability to calculate earthquake, wind, and flood hazards as well as potential economic losses associated with these hazards. The software is designed with the flexibility to perform loss estimations at three different levels. Level 1 utilizes all default parameters built into the software. Levels 2 and 3 require user defined scenarios and building inventory data. For the purpose of this Plan, a Level 1 wind analysis was performed to calculate the wind hazard for King George County. Table 5.2.3c lists the total dollar value of exposed structures based on occupancy type for King George County.

The default data set provided with the HAZUS-MH software is based on the 2000 census data. It is recognized that the current development trends in King George County may render the 2000 census data obsolete. However, this analysis depicts the probability of occurrence and can generally be used to estimate potential damages due to high winds.

Table 5.2.3c
Total Dollar Value of Exposed Structures from HAZUS®*MH* – King George County

Occupancy Type	Total $ Value Exposed Structures
Residential	858,392,000
Commercial	94,012,000
Industrial	13,357,000
Agricultural	867,000
Religion	10,150,000
Government	16,503,000
Education	6,592,000
Total	**999,873,000**

Source: HAZUS

HAZUS®*MH* software provides two options for wind analysis, probabilistic and deterministic. The probabilistic scenario is the default option for the software and activates a database of many thousands of storm tracks and intensities. This scenario generates hurricane hazards based on set return periods. These return periods define the statistical probability that a storm of a given size and intensity could occur within any year. The deterministic method analyses hazards associated with a user defined storm event. The user inputs the storm track, forward speed, and wind speed and allows for the creation of "what-if" scenarios.

The probabilistic wind analysis was chosen because it provides the statistical probability for a range of hurricane events and presents a comparison of these events. The probabilistic analysis was used to generate structural loss estimations for hurricane events with specific recurrence intervals; 10-, 20-, 50-, 100-, 200-, 500-, and 1000-year. The recurrence interval is the average interval of time within which the given hurricane event will be equaled or exceeded once.

Since the residential data comprised a significantly large percentage of the occupancy classification, these data are presented in Table 5.2.3d below. Figure 5.2.3 shows the peak wind gusts, ranging from 69mph to 78mph, generated from a hurricane with 100-year recurrence interval.

Table 5.2.3d
Hurricane Risk - King George County
Summary of Probabilistic Analysis – Residential Structures

Return Period	Residential Building Damage			
	Minor Damage	Moderate Damage	Severe Damage	Total Destruction
10-year	0	0	0	0
20-year	1	0	0	0
50-year	26	1	0	0
100-year	33	1	0	0
200-year	157	8	1	0
500-year	797	97	5	2
1000-year	1,916	538	52	40

Source: HAZUS

Wildfire Vulnerability

The Wildfire Risk Assessment data, provided by the Virginia Department of Forestry, was utilized to estimate the wildfire risk for King George County. This data layer was overlaid with the County tax parcel mapping in order to estimate the value of at risk structures. The VDOF also provided the number of wildfire incidents reported from 1995-2001.

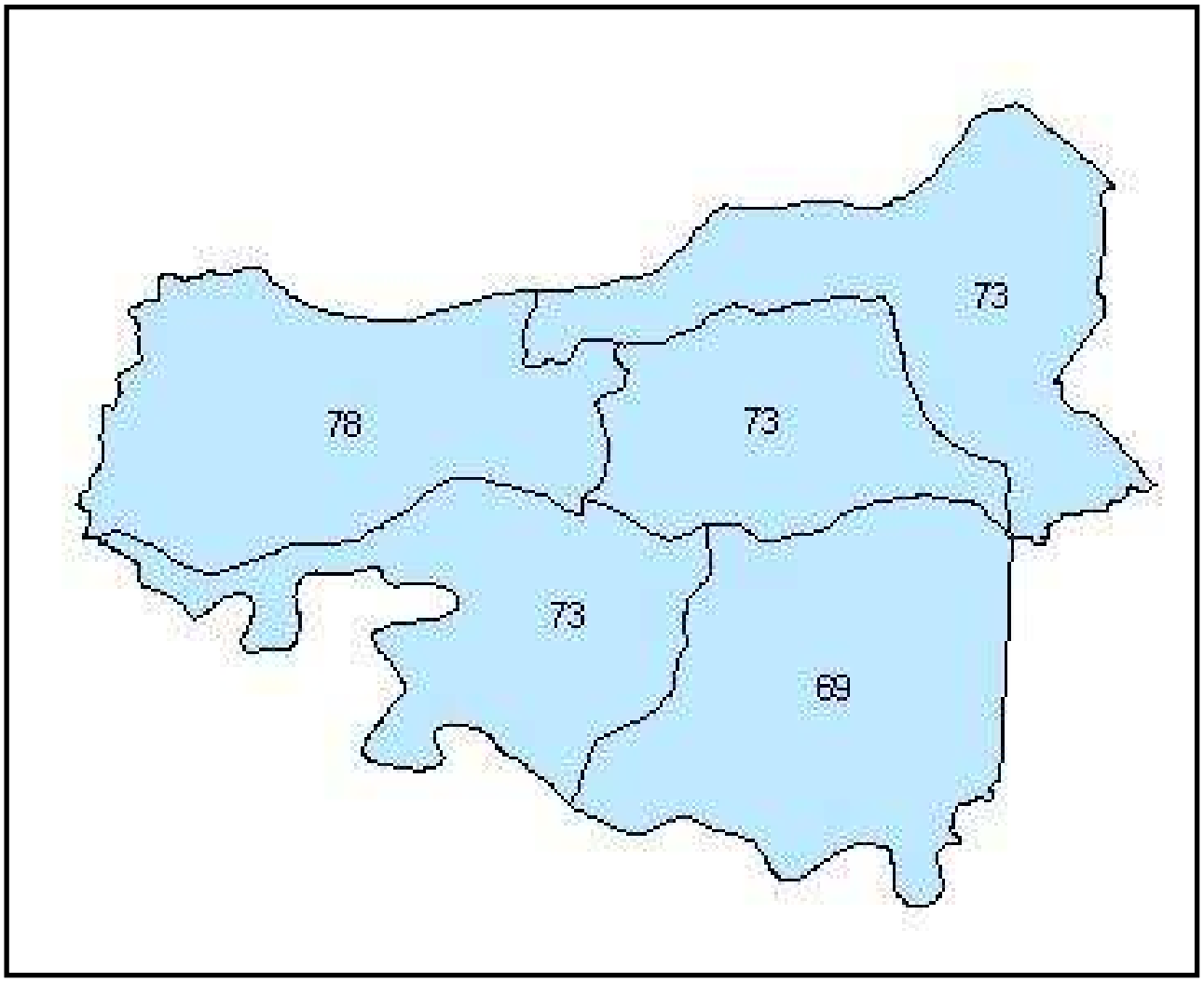
According to the VDOF, 186 incidents of wildfire were reported for King George County from 1995-2001. These events resulted in the burning of 145 acres over this time period. The total value of parcels at risk to wildfire is $372,854,100.

Table 5.2.3d
Wildfire Risk – King George County

Total No. Buildings	No. Buildings in High Wildfire Zone	Estimated at Risk Value
6,226	3,091	$ 372.8 million

Source: Data provided by local emergency management and compiled by AMEC

Figure 5.2.3
Peak Wind Gust (mph) Distribution (100-year)
King George County
(Source: HAZUS)



5.2.4 Spotsylvania County Vulnerability Assessment

Development Trends

Spotsylvania County's close proximity to Washington, D.C. has given the region a recent dramatic population and business increase. The county's development trend is based on its technology and manufacturing industries and suburban housing for Washington D.C./Northern Virginia commuters. Major employers include CVS Pharmacy (distribution warehouse, 450 employees), General Products Company (manufacturing, 375 employees), Diversified Mailing Services (commercial mailing service, 300 employees), and General Motors (manufacturing, 300 employees).

Spotsylvania County has 131,000 resident workers with a 2% unemployment rate. *Demographics Daily* ranked Spotsylvania as the #1 small-business sector in the U.S., and the County takes pride in the diversity of small businesses within its borders. Small businesses experienced a 182% growth rate between 1993 and 1998, and the County population has grown 57.5% in the past ten years, from 57,403 in 1990 to 90,395 in 2000. Spotsylvania County holds the rank of 13th fastest growing county in the U.S (Spotsylvania County, Virginia, 2005, compiled by AMEC).

Critical Facilities

In order to assess the vulnerability of a community to natural hazards, the HMPC conducted an inventory of the structures and critical facilities within Spotsylvania County (Table 5.2.4a). The critical facilities are the community's assets that are the most important or vital to emergency management functions. Critical facilities include:

- Emergency Operation Center (EOC);
- Emergency Communications Center (ECC) / 911;
- Law Enforcement Offices;
- Fire / Rescue Stations;
- Emergency Medical Services (EMS);
- Power;
- Communications;
- Water;
- Wastewater Treatment Plants (WWTP);
- Shelters; and
- Administration Buildings / Courthouse.

Critical facilities are those facilities that warrant special attention in preparing for a disaster and/or facilities that are of vital importance to maintaining citizen life, health, and safety during and/or directly after a disaster event. HMPC member representatives from Spotsylvania County provided the inventory of critical facilities for the county.

Table 5.2.4a
Critical Facilities – Spotsylvania County

Facility Name	Street	Location	Facility Type
911 Center/EOC	9701 Courthouse Rd	Spotsylvania	E-911
Spotsylvania County Sheriff	9701 Courthouse Rd	Spotsylvania	Sheriff
Brokenburg Fire & Rescue	11701 Volunteer Dr	Spotsylvania	Fire/EMS
Courthouse Fire Company 1	9107 American Legion Drive	Spotsylvania	Fire
Courthouse Rescue Station 1	8711 Courthouse Road	Spotsylvania	EMS
Partlow Fire Company 3	3221 Partlow Road	Spotsylvania	Fire
Partlow Rescue Station 3	3530 Partlow Road	Spotsylvania	EMS
4-Mile Fork Fire Company 4	4234 Mine Road	Spotsylvania	Fire
4-Mile Fork Rescue Station 4	10500 Bakers Lane	Spotsylvania	EMS
5-Mile Fork Rescue Station 5	7030 Harrison Road	Spotsylvania	EMS
5-Mile Fork Fire Company 5	5992 Plank Road	Spotsylvania	Fire
Salem Church Road Fire Company and Rescue Station 6	5700 General Semmes Road	Spotsylvania	Fire/EMS
Wilderness Fire Company and Rescue Station 7	10501 Orange Plank Road	Spotsylvania	Fire/EMS
Thornburg Fire Company and Rescue Station 8	6429 Jefferson Davis Hwy.	Spotsylvania	Fire/EMS
Belmont Fire Company and Rescue Station 9	7100 Belmont Road	Spotsylvania	Fire/EMS
Ni River Water Trtmt Plt	10516 Gordon Road	Spotsylvania	Potable Water
Motts Run Water Treatment Plant	13000 Trench Hill Lane	Fredericksburg	Potable Treatment
FMC Wastewater Treatment Plant	11801 Capital Drive	Fredericksburg	Water Treatment
Massaponax Wastewater Treatment Plant	10900 HCC Drive	Fredericksburg	Water Treatment
Stoneybrook Wastewater Treatment Plant	6758 BB Sparrow Lane	Fredericksburg	Water Treatment
Thornburg Wastewater Treatment Plant	5225 Mudd Tavern Road	Woodford	Water Treatment
County Courthouse	9111 Courthouse Road	Spotsylvania	Administration
Holbert Building	9104 Courthouse Road	Spotsylvania	Local Government
Marshall Center	8800 Courthouse Road, 2nd Floor	Spotsylvania	Local Government

Source: Data provided by the Spotsylvania Fire, Rescue, and Emergency Mangement. Assembled by AMEC.

Flooding Vulnerability

A flood vulnerability assessment analysis was performed for Spotsylvania County using valuation data from the Spotsylvania County tax assessor's database and GIS data including parcel location and 100-Year (or 1% chance) flood zones from Spotsylvania County. The parcel and flood zone layers were analyzed in a GIS environment to determine which parcels were located within the 100-Year flood zone. No specific structure layer was available; therefore, the structure location was estimated to be the parcel centroid. The total value of structures within the flood zone was then calculated by linking the selected parcels to the tax assessor's valuation data via a Property Information Number (PIN). Parcels within the 100-Year flood zone that did not have building valuation data in the tax assessor's database were assumed to have no structures. Thus, from a total of 61,792 parcels, 36,885 were assumed to have structures.

It was determined that there are 410 structures within the 100-Year flood zone in Spotsylvania County. The total value of those structures is estimated to be $106.8 million (Table 5.2.4b).

Table 5.2.4b
Flood Risk – Spotsylvania County

Occupancy Type	Total No. Buildings	No. Buildings in 100-year Flood Zone	Estimated at Risk Value
Agriculture	14,050	137	$17.9 million
Residential	21,296	246	$49.4 million
Commercial / Industrial	957	24	$39.1 million
Other	582	3	$0.4 million
Total	36,885	410	$106.8 million

Source: Data provided by Spotsylvania County and compiled by AMEC

A regional map of the 100-year floodplains and the jurisdictions' critical facilities is provided in Appendix B, Map B-5.

Repetitive Loss Areas

Including flood insurance claims paid as a result of flood damage caused by Hurricane Isabel in 2003, FEMA has identified zero structures as repetitive loss structures for Spotsylvania County.

Hurricane Vulnerability

Hazards U.S. – Multi Hazard (HAZUS®*MH*) was utilized to perform a wind hazard analysis for Spotsylvania County. HAZUS®*MH* software is a multi-hazard loss estimation program that was developed under a cooperative agreement between the National Institute of Building Sciences and FEMA. The current version of HAZUS®*MH* has the ability to calculate earthquake, wind, and flood hazards as well as potential economic losses associated with these hazards. The software is designed with the flexibility to perform loss estimations at three different levels. Level 1 utilizes all default parameters built into the software. Levels 2 and 3 require user defined scenarios and building inventory data. For the purpose of this Plan, a Level 1 wind analysis was performed to calculate the wind hazard for Spotsylvania County. Table 5.2.4c lists the total dollar value of exposed structures based on occupancy type for Spotsylvania County.

The default data set provided with the HAZUS®*MH* software is based on the 2000 census data. It is recognized that the current development trends in the RADCO region, and particularly in Spotsylvania County, may render the 2000 Census data obsolete. However, this analysis depicts the probability of occurrence and can generally be used estimate potential damages due to high winds.

Table 5.2.4c
Total Dollar Value of Exposed Structures from HAZUS®*MH* – Spotsylvania County

Occupancy Type	Total $ Value Exposed Structures
Residential	4,796,986,000
Commercial	486,242,000
Industrial	69,741,000
Agricultural	5,324,000
Religion	55,793,000
Government	6,195,000
Education	30,123,000
Total	**5,450,404,000**

Source: HAZUS

HAZUS®*MH* software provides two options for wind analysis, probabilistic and deterministic. The probabilistic scenario is the default option for the software and activates a database of many thousands of storm tracks and intensities. This scenario generates hurricane hazards based on set return periods. These return periods define the statistical probability that a storm of a given size and intensity could occur within any year. The deterministic method analyses hazards associated with a user defined storm event. The user inputs the storm track, forward speed, and wind speed and allows for the creation of "what-if" scenarios.

The probabilistic wind analysis was chosen because it provides the statistical probability for a range of hurricane events and presents a comparison of these events. The probabilistic analysis was used to generate structural loss estimations for hurricane events with specific recurrence intervals; 10-, 20-, 50-, 100-, 200-, 500-, and 1000-year. The recurrence interval is the average interval of time within which the given hurricane event will be equaled or exceeded once.

Since residential comprised a significantly large percentage of the occupancy classification these data are presented in Table 5.2.4d below. Figure 5.2.4 shows the peak wind gusts, ranging from 71mph to 86mph, generated from a hurricane with 100-year recurrence interval.

Table 5.2.4d
Hurricane Risk - Spotsylvania County
Summary of Probabilistic Analysis - Residential Structures

Return Period	Residential Building Damage			
	Minor Damage	Moderate Damage	Severe Damage	Total Destruction
10-year	0	0	0	0
20-year	8	0	0	0
50-year	171	3	0	0
100-year	499	20	0	0
200-year	3,068	287	8	6
500-year	4,820	632	23	17
1000-year	6,839	1,204	61	51

Source: HAZUS

Wildfire Vulnerability

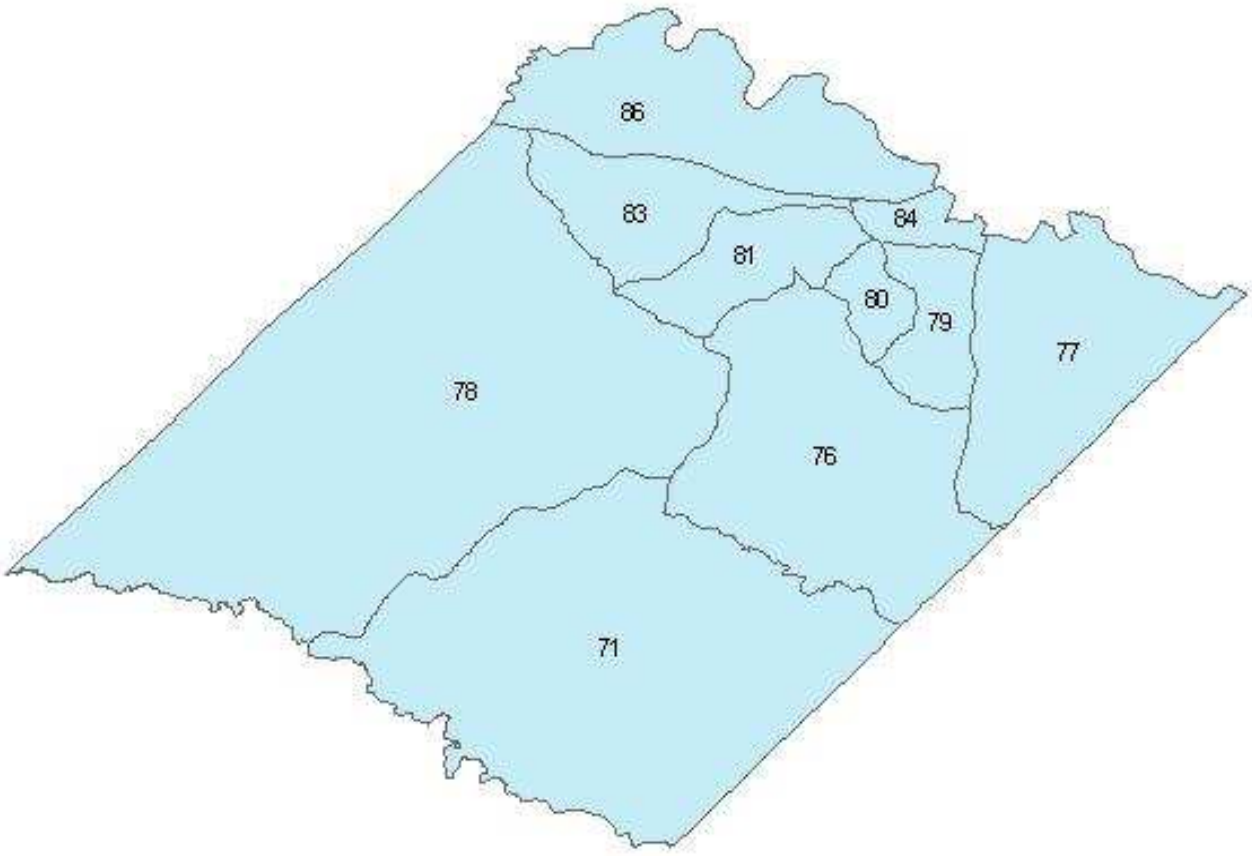
A wildfire vulnerability assessment analysis was performed for Spotsylvania County using valuation data from the Spotsylvania County tax assessor's database, GIS fire risk zone data from the Virginia Department of Forestry, and GIS parcel data from Spotsylvania County. The parcel and fire risk zone layers were analyzed in a GIS environment to determine which parcels were located within a High fire risk zone. No specific structure layer was available; therefore, the structure location was estimated to be the parcel centroid. The total value of structures within the high fire risk zone was then calculated by linking the selected parcels to the tax assessor's valuation data via a Property Information Number (PIN). Parcels within the high fire risk zone that did not have building valuation data in the tax assessor's database were assumed to have no structures.

Approximately 49% of the County falls within a high fire risk zone. It was determined that 21,107 structures are located within this area. The total potential value loss of those structures is estimated to be $2.92 billion.

Table 5.2.4e
Wildfire Risk – Spotsylvania County

Total No. Buildings	No. Buildings in High Wildfire Zone	Estimated at Risk Value
36,885	21,107	$ 2.92 billion

Source: Data provided by local emergency management and compiled by AMEC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6.0 CAPABILITY ASSESSMENT

The capability assessment provides each member jurisdiction with a better understanding of its own preparedness levels and its capability to mitigate against natural hazards. This assessment will assist the RADCO communities to more accurately focus the goals, objectives, and proposed actions of this plan.

The HMPC took two approaches in conducting the capability assessment for its member jurisdictions. First, an inventory of common mitigation activities was made through the use of a matrix. The purpose of this effort was to identify activities and actions that were either in place, needed improvement, or could be undertaken, if deemed appropriate. Second, the HMPC conducted an inventory of existing policies, regulations, and plans. These documents were collected and reviewed to determine if they contributed to reducing hazard related losses, or if they, inadvertently, contributed to increasing such losses.

6.1 Regional Capability Assessment

Federal, State and Regional mitigation capabilities that are common to all communities within the RADCO planning area are presented below. The mitigation capabilities of each community are individually identified and presented in Sections 6.2.1 through 6.2.5.

Federal Capabilities

The National Flood Insurance Program (NFIP)

Established in 1968, the NFIP provides flood insurance in communities that agree to regulate new development in identified Special Flood Hazard Areas through the adoption and enforcement of a minimum Flood Damage Prevention Ordinance. The program also requires, as a condition of every federally-backed mortgage within an identified Special Flood Hazard Area, the purchase and maintenance of a flood insurance policy for the life of the loan.

The Coastal Barrier Resources Act (CoBRA)

Established in 1972, the CoBRA is environmental legislation administered by the U.S. Fish and Wildlife Service. The legislation provides for the identification and protection of Coastal Barrier Resources. The act further prohibits the availability of federally-backed assistance within identified areas, including grants, loans, mortgages and federal flood insurance.

Coastal Zone Management Act (CZMA)

Established in 1972, and amended by the Coastal Zone Protection Act of 1996, the CZMA defines a national interest in the effective management, beneficial use, protection and development of the coastal zone and identifies the urgent need to protect the natural system from these competing interests.

The Virginia Department of Environmental Quality (DEQ) oversees the Virginia Coastal Resources Management Program, which was established to protect and manage an area know as Virginia's "coastal zone." All five of the RADCO communities are located in the coastal zone as defined by Virginia's Coastal Resources Management Area. The program has produced a large number of publications and assisted in the development of numerous projects to support their ten primary goals, available online at http://www.deq.virginia.gov/coastal/goals.html.

Military Installations

Several military installations within the RADCO planning area are not addressed herein: Quantico Marine Corps Base, Fort A.P. Hill, and the Naval District Washington West – Dahlgren Divison. Liaisons from

these facilities were invited to participate in the HMPC and the planning process leading to the creation of this report.

State Capabilities

Virginia Department of Emergency Management (VDEM)

- **VDEM's Strategic Plan 2004-2013**
  This plan recognizes and prepares for Virginia's changing demographics and increasing threats over the next ten-year period. Goals, strategies and resources are built around the mission statement, which is "to protect the lives and property of Virginia's citizens from emergencies and disasters by coordinating the state's emergency preparedness, mitigation, response, and recovery efforts."

- **Commonwealth of Virginia Emergency Operations Plan (State EOP), April 2004:**
  This plan consists of a Disaster Recovery Plan, a Hazard Mitigation Plan, and five hazard-specific volumes. The mitigation goals and project prioritization criteria from Section 4 of Virginia's Hazard Mitigation Plan are:

  - Goal 1 - Structural Mitigation Projects - Maintenance of critical communication, transportation, or supply chain management operations, beneficial impacts for multiple agencies/organizations, feasibility, cost and funding, and multi-hazard mitigation;

  - Goal 2 - Policy, Planning and Funding Human health and safety, preparedness, economic recovery, multi-hazard mitigation, and health care and shelter;

  - Goal 3 - Information and Data Development - Human health, safety or economic stability, multi-hazard mitigation, beneficial impacts for multiple agencies/organizations, feasibility, and information quality and security; and,

  - Goal 4 - Education and Outreach Activities – Number of people and property affected, beneficial impacts for multiple agencies/organization, multi-hazard mitigation, transferability and adaptability, and simplicity and consistency.

- **Virginia Emergency Alert Systems (EAS) Stations**
  Specific AM/FM radio stations provide updated disaster and directional information to listeners in the Commonwealth. Thirty-seven radio stations cover fourteen regions in Virginia, including: Northern Va.-D.C. (2 AM stations, 2 FM stations), Richmond extended area (2 AM stations, 2 FM stations), and Fredericksburg (1 AM station, 2 FM stations, North Anna Early Warning Siren System), which provide coverage for the RADCO planning area.

Virginia Department of Conservation and Recreation (VDCR)

- **Chesapeake Bay Regulations**
  As part of Virginia's commitment to help preserve and restore the resources of the Chesapeake Bay, the Virginia General Assembly adopted the Chesapeake Bay Preservation Act in 1988. The Chesapeake Bay Preservation Area Designation and Management Regulations were adopted in 1990 and amended in December 2001. The revised regulations took effect in March 2002 and localities had until December 31, 2003 to revise their local ordinances to become consistent with the new language.

  The regulations require that communities east of Interstate 95, the "Tidewater" area of Virginia, regulate and enforce the use of Resource Protection Areas (RPAs) and Resource Management Areas (RMAs). The RPA is relevant to floodplain management because new development within the

designated area must maintain a 100-foot buffer from the waterline of any perennial stream, as defined by the regulations. This includes all tidal water bodies in coastal areas. Both the Rappahannock Planning District and the VDCR provide technical assistance and guidance to communities in enforcing the regulations.

- **Virginia Flood Damage Reduction Act**
  Virginia's General Assembly enacted the Virginia Flood Damage Reduction Act of 1989. The legislation was the result of several disastrous floods and coastal storms that impacted the state between 1969 and 1985. To improve Virginia's flood protection programs and place related programs in one agency, responsibility for coordination of all state floodplain programs was transferred in 1987 from the Water Control Board to VDCR. The agency was named manager of the state's floodplain program and designated coordinating agency of the NFIP under the act.

- **Virginia Dam Safety Act**
  The Virginia Soil and Water Conservation Board established the state's dam safety regulations as a result of the passage of the Virginia Dam Safety Act. The Dam Safety Program's purpose is to provide for safe design, construction, operation and maintenance of dams to protect public safety. The program enforces permit requirements related to the construction and alteration of impounding structures. All dams in Virginia are subject to the Dam Safety Act unless specifically excluded. Inundation mapping is required for all Class I and Class II dams in the Commonwealth. Dam Safety Program officials recommend mapping for all classified dams (VS&WCB, 2005).

- **Shoreline Erosion Advisory Service (SEAS)**
  VDCR's Shoreline Erosion Advisory Service promotes environmentally acceptable shoreline and riverbank erosion control measures to protect private property and reduce sediment and nutrient loads to the Chesapeake Bay and other waters of the Commonwealth. In addition, the program promotes research for improved shoreline management techniques to protect and enhance Virginia's shoreline resources.

  Since SEAS was created in 1980, VDCR has provided technical advice about tidal shoreline erosion problems to more than 7,000 clients. They include landowners, local governments and environmental agencies. SEAS program activities also help local governments deal with sediment and nutrient loads from shoreline erosion and, of course, address the Commonwealth's obligation to reduce sediment and nutrient loads in the Chesapeake Bay and its tributaries.

Virginia Department of Forestry (VDOF)

The Virginia Department of Forestry (VDOF) is responsible for the protection of 15.8 million acres of forest land from fire, insects and disease. The principle goals of the Forest Protection Program are to prevent injury or loss of human life, minimize property damage and protect resources.

VDOF has a well-defined and organized forest protection team, with every member of the Department having fire responsibilities. The ability to adapt to emergencies enables a small formal fire suppression force to limit annual fire losses to an average of less than 8200 acres (10-year average). This low average is accomplished through coordination with local fire departments, forest industry, federal agencies, other state agencies and VDOF organized volunteer fire crews.

Virginia Marine Resources Commission (VMRC):

The Virginia Marine Resources Commission was established in 1875 as the Virginia Fish Commission. The Virginia Wetlands Act was passed in 1972 and placed under the management of VMRC, as was the 1980 Coastal Primary Sand Dune Protection Act. In 1982, the General Assembly broadened the 1972 Wetlands Act to include non-vegetated wetlands. The Habitat Management Division issues three types of

Environmental Permits: subaqueous or bottomlands, tidal wetlands, and coastal primary sand dunes. The division's authority specifically regulates physical encroachment into these valuable resource areas.

The permit process relies on a single Virginia joint local/state/Federal permit application. The review process takes into account various local, state and Federal statutes governing the disturbance or alteration of environmental resources. The Marine Resources Commission plays a central role as an information clearinghouse for all three levels of review. Applications receive independent yet concurrent review by the community's Wetlands Board, the VMRC, the Virginia Department of Environmental Quality, and the U.S. Army Corps of Engineers.

Department of Housing and Community Development

The Commonwealth of Virginia is responsible for enacting the Virginia Uniform Statewide Building Code (VUSBC), and each county or city is responsible for enforcing the code locally. As of the first quarter of 2005, the VUSBC is based on the 2000 International Building Code, International Plumbing Code, International Mechanical Code, and International Fire Protection Code, and the 1999 National Electrical Code. The 2003 version of the IBC has been incorporated into the VUSBC, and is expected to go into effect in the near future. The code contains the building regulations that must be complied with when constructing a new building or structure or an addition to an existing building, maintaining or repairing an existing building, or renovating or changing the use of a building or structure.

Enforcement of the VUSBC is the responsibility of the local government's building inspections department. The VUSBC contains enforcement procedures that must be used by the enforcing agency.

As provided in the Uniform Statewide Building Code Law, Chapter 6 (36-97 et seq.) of Title 36 of the Code of Virginia, the USBC supersedes the building codes and regulations of the counties, municipalities and other political subdivisions and state agencies related to any construction, reconstruction, alterations, conversion, repair or use of buildings and installation of equipment therein. The USBC does not supersede zoning ordinances or other land use controls that do not affect the manner of construction or materials to be used in the construction, alteration, or repair.

Rappahannock Area Development Commission (RADCO)

One of 21 Planning District Commissions in the Commonwealth of Virginia, RADCO is a regional organization representing five local governments. Planning District Commissions are voluntary associations created in 1969 pursuant to the *Virginia Area Development Act.* The purpose of planning district commissions, as set out in the Code of Virginia, Section 15.2-4207 is "…to encourage and facilitate local government cooperation and state-local cooperation in addressing on a regional basis problems of greater than local significance." RADCO serves as a resource of technical expertise to its member local governments. Specific programs affiliated with RADCO include transportation, ridesharing, telecommuting, and environmental concerns, which are described below.

Fredericksburg Area Metropolitan Planning Organization (FAMPO)

FAMPO undertakes regional transportation planning activities in the area encompassing the City of Fredericksburg, Spotsylvania County, and Stafford County. RADCO staff makes up the designated staff for FAMPO. Based upon the 1990 Census, the Fredericksburg, VA area was designated an urbanized area (population greater than 50,000). To continue receiving federal funds for transportation improvements, federal law requires all urbanized areas in the United States to conduct the "3-C" (continuing, comprehensive and cooperative) transportation planning process. In response to the Census designation, a "Memorandum of Understanding" was signed in November 1992 between the Commonwealth of Virginia, the three jurisdictions, and the Potomac and Rappahannock Transportation Commission (PRTC) to create FAMPO, which is the body responsible for ensuring that the 3-C planning

process takes place. RADCO staff also undertakes transportation planning activities in Caroline and King George Counties through the RADCO Rural Transportation Planning Assistance Program.

RADCO Rideshare

RADCO Rideshare assists persons who are seeking daily transportation from the RADCO area to employment locations in the greater Washington DC, Northern Virginia, Dahlgren, and Richmond areas. Some of the commuting options include carpools, vanpools, bus, commuter Rail (Virginia Railway Express), and Metro. The ridership program also assists with Metrochek redemption for vanpools, Vanpool assistance, and guaranteed ride home (MWCOG).

Fredericksburg Regional/Woodbridge Telework Centers

There are seven NoCommute.org telework centers and they are a part of a pilot project sponsored by the General Services Administration. They represent a cooperative effort between the federal government, state and local government, academia and private sector. The centers are open to both federal employees as well as private sector employees. The three centers along Interstate 95 (Woodbridge, Stafford, and Fredericksburg) are operated by the Rappahannock Area Development Commission. The main purpose of these centers is enabling people to avoid long commutes to their normal workplace (office). Not everyone who teleworks can or chooses to do so from their house. These centers provide an attractive alternative.

Fredericksburg Regional Alliance (FRA)

FRA is a public, private economic development marketing partnership created to provide CEOs, presidents, corporate real estate executives, facility planners, and site selection consultants with a single source for comprehensive demographic and economic information on the Fredericksburg Region -- which includes the City of Fredericksburg and the counties of Caroline, King George, Spotsylvania, and Stafford -- while also providing a wide range of services designed to facilitate the site selection process.
By working in cooperation with local economic development offices, the Virginia Employment Commission (VEC), educational institutions, and other regional groups, the Alliance is able to offer a truly comprehensive collection of services and information, including: demographic and economic data; community tours; site, building, and office space inspections; industry-specific wage, workforce, and labor availability information; tax and cost of living comparisons; financing options; and confidential project-specific proposals from localities.

The Rappahannock River Basin Commission (RRBC)

The Water Allocation Group was created by the Rappahannock River Basin Commission in the spring of 2000 to facilitate and encourage the planning for water allocation, including water supply and discharge in the Rappahannock. Participants include local and state elected officials, representatives of utilities departments in the basin, local, state and federal environmental agencies and others. The Water Allocation Group is chaired by the Chair of the Rappahannock River Basin Commission. The Water Allocation Group has developed many recommendations for the Commission which have in turn been adopted and forwarded to member localities and the Commonwealth of Virginia. A major project of the Water Allocation Group was the development of the Water Supply Planning Model.

To assist in water resource planning the Rappahannock Basin has several documents out to assist the local communities. These documents are Guiding Principles for Water Resource Planning, Planning for Groundwater use in the Rappahannock Basin, and Groundwater Planning: Recommendations by the Water Allocation Group to the Rappahannock River Basin Commission.

6.2 Community Specific Capability Assessment

6.2.1 Caroline County, including the Town of Bowling Green and the Town of Port Royal, Capability Assessment

As an additional tool to assist with the examination of the hazards identified and to evaluate the community's ability to plan, develop, and implement hazard mitigation activities, the HMPC developed a local capability assessment for Caroline County and the Towns of Bowling Green and Port Royal. This assessment is designed to highlight both the regulatory tools available to the community to assist with natural hazard mitigation and the other community assets that may help facilitate the planning and implementation of natural hazard mitigation over time. The capability matrices presented in Tables 6.2.1a, 6.2.1b, and 6.2.1c outline the current and planned programming that will impact the ability of Caroline County, the Town of Bowling Green, and the Town of Port Royal, respectively, to plan for and mitigate against natural hazards.

Form of Governance

Caroline County is governed by an elected Board of Supervisors and administered on a day-to-day basis by a County Administrator and departmental staff. The Town of Bowling Green is governed by an elected Town Council and Mayor and administered on a day-to-day basis by a Town Manager. An elected Board of Directors has been established to protect the historical integrity of Port Royal.

Guiding Community Documents

Caroline County has a range of guidance documents and plans for each of their departments. These include a comprehensive plan, suggested facility development standards, utilities plans, capital improvement plans, and emergency management plans. The County uses building codes, zoning ordinances, subdivision ordinances, and various planning strategies to address how and where development occurs. One essential planning document to the County is it's Comprehensive Plan.

Comprehensive Plan, 2001

- Presents policies and strategies for growth management plan and recognizes the value in preserving the desired rural characteristics of the County
- Ensures responsible stewardship of the County's natural and historic resources, including riparian buffers, floodplains, wetlands, and historic structures and places
- Plans for continued growth and development in designated growth areas, including:
    - Bowling Green/Milford Primary Growth Area
    - Skinker's Neck Growth Area
    - Carmel Church and Ladysmith Sub-areas
    - Secondary Growth Areas – Port Royal, Chilesburg, Dawn, and Sedon
- Plans for necessary transportation enhancements and improvements to service projected growth
- Plans for operation and expansion of public facilities to accommodate expected growth in the County. Facilities include water and sewer service facilities, public libraries, first response emergency services facilities (fire/EMS stations), and parks and recreation facilities.

Zoning & Development Standards

- Identifies existing federal and state regulations.
- Most of document recommends policies and standards for new and existing development.

Building Codes

The Commonwealth of Virginia is responsible for enacting the Virginia Uniform Statewide Building Code, which the County is responsible for enforcing locally. As of October of 2003, the Uniform Statewide Building Code was based on the IBC, IRC, and IFPC.

The Building Code Effectiveness Grading Schedule (BCEGS) assesses the building codes in effect in a particular community and how the community enforces its building codes, with special emphasis on mitigation of losses from natural hazards. Municipalities with well-enforced, up-to-date codes should demonstrate better loss experience, and insurance rates can reflect that. The BCEGS program assigns each municipality a BCEGS grade of 1 (exemplary commitment to building-code enforcement) to 10. The BCEGS grade for Caroline County is presented in Table 6.2.1a.

Public Education

Among the public outreach mechanisms available in Caroline County, the County's website (http://www.co.caroline.va.us) provides County residents with pertinent information, provides an on-line complaint form, and answers several Frequently Asked Questions (FAQs). The County also posts most of its guiding documents, including the Comprehensive Plan on this site.

Emergency Preparedness

Caroline County utilizes a cable access channel to notify residents of information which may include emergency preparedness.

Table 6.2.1a
Capability Matrix - Caroline County

Capability	Caroline County
Comprehensive Plan	Yes
Land Use Plan	Yes
Subdivision Ordinance	Yes
Zoning Ordinance	Yes
NFIP/FPM Ordinance	Yes
-Effective FIRM Date	15-August-89
-Substantial Damage Language	Yes
- Certified Floodplain Manager	No
- # of Floodprone Parcels	2,226
- # of NFIP policies	41
- Maintain Elevation Certificates	No
- # of Repetitive Losses	0
CRS Rating	N/A
Stormwater Program	Yes
Building Code Version Full-time Building Official	USBC 2000 Edition (based on IBC)
- Conduct “As-built” Inspections	Yes
BCEGS Rating	Residential - 3; Commercial - 3
Local Emergency Operations Plan	Yes
Hazard Mitigation Plan	In Process
Warning Systems in Place	Poor
- Storm Ready Certified	No
- Weather Radio Reception	Poor
- Outdoor Warning Sirens	No
-Emergency Notification (R-911)	Yes
-other? (e.g., cable over-ride)	Yes-Cable-Emergency Alert System
GIS system	No
-Hazard Data	No
-Building footprints	No
-Tied to Assessor data	No
-Land Use designations	No
Structural Protection Projects	No
Property Owner Protection Projects	Yes-Acquisition/Elevation
Critical Facilities Protected	No
Natural Resource Inventory	Yes
Cultural Resources Inventory	Yes
Erosion Control Procedures	Yes
Sediment Control Procedures	Yes
Public Information Program/Outlet	Yes
Environmental Education Program	Yes

Source: Data provided by RADCO and Caroline County. Assembled by AMEC.

Table 6.2.1b
Capability Matrix – Town of Bowling Green

Capability	Town of Bowling Green
Comprehensive Plan	Yes
Land Use Plan	Yes
Subdivision Ordinance	Yes
Zoning Ordinance	Yes
NFIP/FPM Ordinance	No
-Effective FIRM Date	No FIS
-Substantial Damage Language	N/A
- Certified Floodplain Manager	No
- # of Floodprone Buildings	N/A
- # of NFIP policies	N/A
- Maintain Elevation Certificates	No
- # of Repetitive Losses	N/A
CRS Rating	N/A
Stormwater Program	No
Building Code Version Full-time Building Official	USBC 2000 Edition (based on IBC)
- Conduct “As-built” Inspections	Yes
BCEGS Rating	No
Local Emergency Operations Plan	Yes
Hazard Mitigation Plan	In Process
Warning Systems in Place	Yes
- Storm Ready Certified	No
- Weather Radio Reception	Yes
- Outdoor Warning Sirens	No
-Emergency Notification (R-911)	No
-other (e.g., cable over-ride)	Yes-Cable-Emergency Alert System
GIS system	No
-Hazard Data	N/A
-Building footprints	N/A
-Tied to Assessor data	N/A
-Land Use designations	N/A
Structural Protection Projects	No
Property Owner Protection Projects	No
Critical Facilities Protected	No
Natural Resource Inventory	Yes
Cultural Resources Inventory	Yes
Erosion Control Procedures	Yes
Sediment Control Procedures	Yes
Public Information Program/Outlet	No
Environmental Education Program	No

Source: Data provided by RADCO and Caroline County. Assembled by AMEC.

Table 6.2.1c
Capability Matrix – Town of Port Royal

Capability	Town of Port Royal
Comprehensive Plan	Yes
Land Use Plan	Yes
Subdivision Ordinance	Yes
Zoning Ordinance	Yes
NFIP/FPM Ordinance	No
-Effective FIRM Date	22-July-77
-Substantial Damage Language	No
- Certified Floodplain Manager	No
- # of Floodprone Buildings	0
- # of NFIP policies	0
- Maintain Elevation Certificates	No
- # of Repetitive Losses	0
CRS Rating	No
Stormwater Program	No
Building Code Version Full-time Building Official	USBC 2000 Edition (based on IBC)
- Conduct “As-built” Inspections	Yes (County)
BCEGS Rating	No
Local Emergency Operations Plan	Yes
Hazard Mitigation Plan	In process
Warning Systems in Place	Yes
- Storm Ready Certified	No
- Weather Radio Reception	Yes
- Outdoor Warning Sirens	No
-Emergency Notification (R-911)	No
-other (e.g., cable over-ride)	Yes-Cable-Emergency Alert System
GIS system	No
-Hazard Data	No
-Building footprints	No
-Tied to Assessor data	N/A
-Land Use designations	N/A
Structural Protection Projects	No
Property Owner Protection Projects	No
Critical Facilities Protected	No
Natural Resource Inventory	No
Cultural Resources Inventory	Yes
Erosion Control Procedures	Yes (County)
Sediment Control Procedures	Yes (County)
Public Information Program/Outlet	No
Environmental Education Program	No

Source: Data provided by RADCO and Caroline County. Assembled by AMEC.

6.2.2 City of Fredericksburg Capability Assessment

As an additional tool to assist with the examination of the hazards identified and to evaluate the community's ability to plan, develop, and implement hazard mitigation activities, the HMPC developed a local capability assessment for the City of Frederickburg. This assessment is designed to highlight both the regulatory tools available to the community to assist with natural hazard mitigation and the community assets that may help facilitate the planning and implementation of natural hazard mitigation over time. The capability matrix presented in Table 6.2.2 outlines the locality's current and planned programming that will impact the community's ability to plan for and mitigate against natural hazards.

Form of Governance

A six-member City Council and a Mayor govern the City of Fredericksburg. The Mayor and two Council members are elected at large while the remaining four Council members are elected from the City's four wards. The City Manager and the various departments under the City Manager's authority carry out the day-to-day administration of the City's services and programming.

Guiding Community Documents

The City of Fredericksburg has a range of guidance documents and plans for each of their departments. These include a comprehensive plan, public works, and public utilities plans, capital improvement plans, and emergency management plans. The City uses building codes, zoning ordinances, subdivision ordinances, and various planning strategies to address how and where development occurs. One essential way the jurisdiction guides its future is through policies laid out in the Comprehensive Plan.

Comprehensive Plan, 1999

- Presents policies and strategies for growth management plan and recognize the value in preserving the desired rural characteristics of the City.
- Recognizes the value of the City's considerable natural, cultural, and historic resources.
- Recognizes the impacts of regional facilities, transportation corridors, and hospital facilities
- Ensures that development is done in an environmentally sensitive, planned manner that serves to preserve environmentally sensitive features such as floodplains, wetlands and natural topography.
- Develops a well planned, efficient, effective and safe transportation system that meets local, regional and interstate transportation needs.
- Preserves the City's historic resources that provide valuable information about the proud history of the City and its residents.
- Recognizes State and federal flood and other water resource regulations, including the Chesapeake Bay Preservation Act.

Zoning & Development Standards

- Identifies existing federal and state regulations.
- Recommends policies and standards for new and existing development.

Building Codes

The Commonwealth of Virginia is responsible for enacting the Virginia Uniform Statewide Building Code, which the City is responsible for enforcing locally. As of October of 2003, the Uniform Statewide Building Code is based on the IBC, IRC, and IFPC.

The Building Code Effectiveness Grading Schedule (BCEGS) assesses the building codes in effect in a particular community and how the community enforces its building codes, with special emphasis on mitigation of losses from natural hazards. Municipalities with well-enforced, up-to-date codes should demonstrate better loss experience, and insurance rates can reflect that. The BCEGS program assigns each municipality a BCEGS grade of 1 (exemplary commitment to building-code enforcement) to 10. The BCEGS grade for the City of Fredericksburg is presented in Table 6.2.2.

Public Education

Among the readily available public outreach mechanisms available in the City of Fredericksburg, the City's website (http://www.fredericksburgva.gov) provides City residents with pertinent information, including local events and information on the City's rich cultural history, and answers several Frequently Asked Questions (FAQs). The City also posts most of its guiding documents, including the Comprehensive Plan on this site.

Emergency Preparedness

The City of Fredericksburg utilizes a cable access channel to notify residents of information which may include emergency preparedness.

Table 6.2.2
Capability Matrix - City of Fredericksburg

Capability	City of Fredericksburg
Comp Plan	Yes
Land Use Plan	Yes
Subdivision Ordinance	Yes
Zoning Ordinance	Yes
NFIP/FPM Ordinance	Yes
-Effective FIRM Date	2-July-79
-Substantial Damage Language	Yes
- Certified Floodplain Manager	No
- # of Floodprone Buildings	300
- # of NFIP policies	164
- Maintain Elevation Certificates	Yes
- # of Repetitive Losses	4
CRS Rating	N/A
Stormwater Program	Yes
Building Code Version Full-time Building Official	USBC 2000 Edition (based on IBC)
- Conduct “As-built” Inspections	Yes
BCEGS Rating	Residential - 4; Commercial - 4
Local Emergency Operations Plan	Yes
Hazard Mitigation Plan	In Process
Warning Systems in Place	Yes
- Storm Ready Certified	No
- Weather Radio Reception	Yes, Poor
- Outdoor Warning Sirens	No
-Emergency Notification (R-911)	No
-other? (e.g., cable over-ride)	Yes-Emergency Alert System
GIS system	No
-Digital Hazard Data	No
-Digital Building footprints	No
-Tied to Assessor data	No
-Land Use designations	No
Structural Protection Projects	No
Property Owner Protection Projects	No
Critical Facilities Protected	No
Natural Resource Inventory	Yes
Cultural Resources Inventory	Yes
Erosion Control Procedures	Yes
Sediment Control Procedures	Yes
Public Information Program/Outlet	Yes
Environmental Education Program	Yes

Source: Data provided by RADCO and the City of Fredericksburg. Assembled by AMEC.

6.2.3 King George County Capability Assessment

As an additional tool to assist with the examination of the hazards identified and to evaluate the community's ability to plan, develop, and implement hazard mitigation activities, the HMPC developed a local capability assessment for King George County. This assessment is designed to highlight both the regulatory tools available to the community to assist with natural hazard mitigation and the community assets that may help facilitate the planning and implementation of natural hazard mitigation over time. The capability matrix presented in Table 6.2.3 outlines the locality's current and planned programming that will impact the community's ability to plan for and mitigate against natural hazards.

Form of Governance

The County is governed by an elected Board of Supervisors and administered on a day-to-day basis by a County Administrator and departmental staff.

Guiding Community Documents

King George County has a range of guidance documents and plans for each of their departments. These include a comprehensive plan, subdivision ordinance, zoning ordinance, capital improvement plans, and emergency management plans. In addition, the King George County Service Authority administers the standards and specifications governing water and sewer utility service. The County uses building codes, zoning ordinances, subdivision ordinances, and various planning strategies to address how and where development occurs. One essential way the jurisdiction guides its future is through policies laid out in the Comprehensive Plan.

Comprehensive Plan, adopted May 25, 2000

The County's current Comprehensive Plan outlines the County's future planning goals, including:

- Accommodate population and employment growth in a compact pattern by directing the majority of new development to locate in the major existing settlements, especially the Courthouse and Dahlgren areas.
- Manage the location and expansion of water and sewer utilities and the location of community facilities such as Schools, Parks and Recreation and Emergency Services in such a way as to provide needed services, while reinforcing the desired compact development pattern.
- Pursue the design and construction of a limited-access connector road north of the Courthouse to relieve traffic from Route 206 and the Courthouse area.
- Plan for additional traffic management options in the long term.
- Manage development and new access points along major road corridors in order to protect safety, capacity and visual quality of these critical roads.
- Implement land development regulations to protect critical environmental resources.

Zoning & Development Standards

- Identifies existing federal and state regulations.
- Provides policies and standards for new and existing development as allowed by the Code of Virginia.

Subdivision ordinance, adopted December 17, 2002

- The purpose of this ordinance is to establish standards for the subdivision of land and development procedures for King George County.

Building Codes

The Commonwealth of Virginia is responsible for enacting the Virginia Uniform Statewide Building Code, which the County is responsible for enforcing locally. As of October of 2003, the Uniform Statewide Building Code is based on the IBC, IRC, and IFPC.

The Building Code Effectiveness Grading Schedule (BCEGS) assesses the building codes in effect in a particular community and how the community enforces its building codes, with special emphasis on mitigation of losses from natural hazards. Municipalities with well-enforced, up-to-date codes should demonstrate better loss experience, and insurance rates can reflect that. The BCEGS program assigns each municipality a BCEGS grade of 1 (exemplary commitment to building-code enforcement) to 10. The BCEGS grade for King George County is presented in Table 6.2.3.

Public Education

Among the readily available public outreach mechanisms available in King George County, the County's website (http://www.king-george.va.us) provides County residents with pertinent information, provides an on-line complaint form, and answers several Frequently Asked Questions (FAQs). The County posts most of its guiding documents, including the Comprehensive Plan on this site. KGALERT also serves as a source of public education through the availability and presentation of disaster and emergency preparedness information.

Emergency Preparedness

The County is served by Metrocast Cable, which provides cable services for County residents. King George County does not have access to override the cable channel for emergency information purposes, there is no EAS Activation capability. The County does have access to the public access channel for posting information.

Table 6.2.3
Capability Matrix – King George County

Capability	King George County
Comprehensive Plan	Yes
Land Use Plan	Yes
Subdivision Ordinance	Yes
Zoning Ordinance	Yes
NFIP/FPM Ordinance	Yes
-Effective FIRM Date	15-Dec-90
-Substantial Damage Language	Yes
- Certified Floodplain Manager	No
- # of Floodprone Buildings	704
- # of NFIP policies	19
- Maintain Elevation Certificates	Yes
- # of Repetitive Losses	0
CRS Rating	N/A
Stormwater Program	No
Building Code Version Full-time Building Official	USBC 2000 Edition (based on IBC)
- Conduct “As-built” Inspections	Yes
BCEGS Rating	Residential – 4; Commercial - 4
Local Emergency Operations Plan	Yes
Hazard Mitigation Plan	In Progress
Warning Systems in Place	Yes
- Storm Ready Certified	No
- Weather Radio Reception	Medium Coverage
-Emergency Notification (R-911)	Yes
-other? (e.g., cable over-ride)	KGALERT, no cable override
GIS system	Yes
-Hazard Data	Yes
-Building footprints	Yes
-Tied to Assessor data	Yes
-Land Use designations	Yes
Structural Protection Projects	Yes
Property Owner Protection Projects	No
Critical Facilities Protected	Minimal
Natural Resource Inventory	Yes
Cultural Resources Inventory	Yes
Erosion Control Procedures	Yes
Sediment Control Procedures	Yes
Public Information Program/Outlet	Yes
Environmental Education Program	Yes

Source: Data provided by RADCO and King George County. Assembled by AMEC.

6.2.4 Spotsylvania County Capability Assessment

As an additional tool to assist with the examination of the hazards identified and to evaluate the community's ability to plan, develop, and implement hazard mitigation activities, the HMPC developed a local capability assessment for Spotsylvania County. This assessment is designed to highlight both the regulatory tools available to the community to assist with natural hazard mitigation and the community assets that may help facilitate the planning and implementation of natural hazard mitigation over time. The capability matrix presented in Table 6.2.4 outlines the locality's current and planned programming that will impact the community's ability to plan for and mitigate against natural hazards.

Form of Governance

The County is governed by an elected Board of Supervisors and administered on a day-to-day basis by a County Administrator and subsequent departmental staff.

Guiding Community Documents

Spotsylvania County has a range of guidance documents and plans for each of their departments. These include a comprehensive plan, public works, and public utilities plans, capital improvement plans, and emergency management plans. The County uses building codes, zoning ordinances, subdivision ordinances, and various planning strategies to address how and where development occurs. One essential way the jurisdiction guides its future is through policies laid out in the Comprehensive Plan.

Comprehensive Plan, adopted February 2002

- Presents policies and strategies for growth management plan and recognizes the value in preserving the desired rural characteristics of the County.
- Strategizes to preserve the natural environment, "open space" and areas deserving special attention while providing sufficient designated growth areas to accommodate expected demand for business and residential growth.
- Strategizes regulating open burning, and considers eliminating open burning for land clearing. Statewide fire prevention code adopted.
- Ensures that development is done in an environmentally sensitive, planned manner that serves to preserve environmentally sensitive features such as floodplains, wetlands and natural topography.
- Develops a well planned, efficient, effective and safe transportation system that meets local, regional and interstate transportation needs.
- Preserves the County's historic resources that provide valuable information about the proud history of the County and its residents.
- Improves planning information resources by completing, performing and maintaining surveys of existing resources, land uses, and facilities.
- Recognizes State and Federal flood regulations.

Zoning & Development Standards

- Identifies existing federal and state regulations.
- Recommends policies and standards for new and existing development.

Building Codes

The Commonwealth of Virginia is responsible for enacting the Virginia Uniform Statewide Building Code, which the County is responsible for enforcing locally. As of October of 2003, the Uniform Statewide Building Code is based on the IBC, IRC, and IFPC.

The Building Code Effectiveness Grading Schedule (BCEGS) assesses the building codes in effect in a particular community and how the community enforces its building codes, with special emphasis on mitigation of losses from natural hazards. Municipalities with well-enforced, up-to-date codes should demonstrate better loss experience, and insurance rates can reflect that. The BCEGS program assigns each municipality a BCEGS grade of 1 (exemplary commitment to building-code enforcement) to 10. The BCEGS grade for Spotsylvania County is presented in Table 6.2.4.

Public Education

Among the readily available public outreach mechanisms available in Spotsylvania County, the County's website (http://www.co.spotsylvania.va.us) provides County residents with pertinent information, provides updates on County programming and events, and answers several Frequently Asked Questions (FAQs). The County also posts most of its guiding documents, including the Comprehensive Plan on this site.

Emergency Preparedness

Spotslyvania County utilizes a cable access channel to notify residents of important information. The County does have access to override all cable channels for EAS activation. Additionally, the Department of Fire, Rescue, and Emergency Management website has links to multiple websites providing information on emergency preparedness (http://www.spotsylvania.va.us/departments/fireandrescue/).

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Table 6.2.4
Capability Matrix – Spotsylvania County

Capability	Spotsylvania County
Comp Plan	Yes
Land Use Plan	Yes
Subdivision Ordinance	Yes
Zoning Ordinance	Yes
NFIP/FPM Ordinance	Yes
-Effective FIRM Date	18-February-98
-Substantial Damage Language	Yes
- Certified Floodplain Manager	Yes
- # of Floodprone Buildings	410
- # of NFIP policies	135
- Maintain Elevation Certificates	Yes
- # of Repetitive Losses	0
CRS Rating	No
Stormwater Program	Yes
Building Code Version	USBC 2000 Edition (based on IBC)
Full-time Building Official	Yes
- Conduct “As-built” Inspections	Yes
BCEGS Rating	Residential - 4; Commercial - 3
Local Emergency Operations Plan	Yes
Hazard Mitigation Plan	In Process
Warning Systems in Place	Yes
- Storm Ready Certified	No
- Weather Radio Reception	Yes; medium coverage
- Outdoor Warning Sirens	Yes; 10 mile radius around the North Anna Power Station
-Emergency Notification (R-911)	Yes
-other (e.g., cable over-ride)	Yes-Cable-Emergency Alert System
GIS system	Yes
-Hazard Data	Yes
-Building footprints	Yes
-Tied to Assessor data	Yes
-Land Use designations	Yes
Structural Protection Projects	No
Property Owner Protection Projects	No
Critical Facilities Protected	No
Natural Resource Inventory	Yes
Cultural Resources Inventory	Yes
Erosion Control Procedures	Yes
Sediment Control Procedures	Yes
Public Information Program/Outlet	Yes
Environmental Education Program	Yes

Source: Data provided by RADCO and Spotsylvania County. Assembled by AMEC.

6.2.5 Stafford County Capability Assessment

As an additional tool to assist with the examination of the hazards identified and to evaluate the community's ability to plan, develop, and implement hazard mitigation activities, the HMPC developed a local capability assessment for Stafford County. This assessment is designed to highlight both the regulatory tools available to the community to assist with natural hazard mitigation and the community assets that may help facilitate the planning and implementation of natural hazard mitigation over time. The capability matrix presented in Table 6.2.5 outlines the locality's current and planned programming that will impact the community's ability to plan for and mitigate against natural hazards.

Form of Governance

The County is governed by an elected Board of Supervisors and administered on a day-to-day basis by a County Administrator and subsequent departmental staff.

Guiding Community Documents

Stafford County has a range of guidance documents and plans for each of their departments. These include a comprehensive plan, public works, and public utilities plans, capital improvement plans, and emergency management plans. The County uses building codes, zoning ordinances, subdivision ordinances, and various planning strategies to address how and where development occurs. One essential way the region guides its future is through policies laid out in the Comprehensive Plan.

Comprehensive Plan, adopted February 2003

- Plans and analysis of the County's transportation, land use, environmental, and public resources.
- Accounts for the County's desire to retain the viability of its agricultural enterprises and heritage; implement a multi-faceted economic development program; establishment of adequate public infrastructure for planned growth and development trends; and improve and enhance both the man-made and natural environment in the County.
- Accounts for urban, suburban, and rural/agricultural land uses in designated corridors.

Zoning & Development Standards

- Identifies existing federal and state regulations.
- Recommends policies and standards for new and existing development.

Building Codes

The Commonwealth of Virginia is responsible for enacting the Virginia Uniform Statewide Building Code, which the County is responsible for enforcing locally. As of October of 2003, the Uniform Statewide Building Code is based on the IBC, IRC, and IFPC.

The Building Code Effectiveness Grading Schedule (BCEGS) assesses the building codes in effect in a particular community and how the community enforces its building codes, with special emphasis on mitigation of losses from natural hazards. Municipalities with well-enforced, up-to-date codes should demonstrate better loss experience, and insurance rates can reflect that. The BCEGS program assigns each municipality a BCEGS grade of 1 (exemplary commitment to building-code enforcement) to 10. The BCEGS grade for Stafford County is presented in Table 6.2.5.

Public Education

Among the readily available public outreach mechanisms available in Stafford County, the County's website (http://www.co.stafford.va.us) provides County residents with pertinent information, provides updates on County programming and events, and answers several Frequently Asked Questions (FAQs). The County also posts most of its guiding documents, including the Comprehensive Plan on this site.

Emergency Preparedness

Stafford utilizes a cable access channel to notify residents of important information. The County does have access to override all cable channels for EAS activation.

Table 6.2.5
Capability Matrix – Stafford County

Capability	Stafford County
Comp Plan	Yes
Land Use Plan	Yes
Subdivision Ordinance	Yes
Zoning Ordinance	Yes
NFIP/FPM Ordinance	Yes
-Effective FIRM Date	February 4, 2005
-Substantial Damage Language	Yes
- Certified Floodplain Manager	Yes
- # of Floodprone Buildings	1,916
- # of NFIP policies	288
- Maintain Elevation Certificates	Yes
- # of Repetitive Losses	8
CRS Rating	N/A
Stormwater Program	Yes
Building Code Version Full-time Building Official	USBC 2000 Edition (based on IBC)
- Conduct "As-built" Inspections	Yes
BCEGS Rating	Residential - 4; Commercial - 4
Local Emergency Operations Plan	Yes
Hazard Mitigation Plan	In Process
Warning Systems in Place	Yes
- Storm Ready Certified	No
- Weather Radio Reception	Yes; medium coverage
- Outdoor Warning Sirens	No
-Emergency Notification (R-911)	Yes
-other? (e.g., cable over-ride)	Yes-Emergency Broadcast System
GIS system	Yes
-Hazard Data	Yes
-Building footprints	Yes
-Tied to Assessor data	Yes
-Land Use designations	Yes
Structural Protection Projects	No
Property Owner Protection Projects	Yes-Acquisition/Elevation
Critical Facilities Protected	No
Natural Resource Inventory	Yes
Cultural Resources Inventory	Yes
Erosion Control Procedures	Yes
Sediment Control Procedures	Yes
Public Information Program/Outlet	Yes
Environmental Education Program	Yes

Source: Data provided by RADCO and Stafford County. Assembled by AMEC.

7.0 MITIGATION GOALS AND OBJECTIVES

Section 5 documents the risks from and vulnerabilities to the natural hazards that threaten the RADCO communities. With the additional information provided through the assessment of existing mitigation capabilities, Section 6, the HMPC began to formulate mitigation planning goals. The intent of the goal setting process is to identify areas where improvements to existing capabilities can be made so that community vulnerability is reduced.

Before formulating the goals for this plan, the HMPC first reviewed planning goals in general. Each HMPC member was provided with a written and graphic explanation of goals and objectives, the purpose they serve and how they are developed and written. Following this activity, each HMPC member was provided with an alphabetized list of sample goal statements. Some of these goals were from existing plans, some were from the communities themselves, some were developed as a result of analyzing the Risk Assessment, and some were generic community planning goals, such as "Improve Public Safety Services."

The HMPC participated in a discussion of the sample goal statements, and developed an understanding of the relationship of plan goals and objectives to the recommended actions that they would later be tasked to formulate. Following this discussion, each HMPC member received three index cards and was asked to write what they felt would be the most appropriate goals for this plan - one on each card - using the possible goal statements as a guide.

HMPC members were instructed that they could use, combine or revise the sample statements or develop entirely new goals. Team members then posted their cards to the meeting room wall, and the goal statements were placed into similar groups, combined, rewritten and agreed upon. Upon group review, some of the proposed goal statements were determined to be better suited as objectives or actual mitigation projects – and were set aside for later use.

Based upon the planning data review and the process described above, the HMPC developed the final regional goal and objective statements listed below. None of the final goal statements are the same as those provided on the alphabetized list. These goals and objectives provide direction for reducing future hazard-related losses for the RADCO communities.

GOAL #1: Reduce the future impacts and losses from identified hazards.

Objective 1.1: Develop a coordinated set of mitigation actions that address the following specific hazards:

a. *Flooding;*
b. *Wildfires; and*
c. *Severe Weather (tornadoes, winter storms, northeasters, and hurricanes).*

Objective 1.2: Protect critical facilities.

GOAL #2: Educate and engage the public regarding hazards, their impacts, and feasible actions.

Objective 2.1: Develop a seasonal multi-hazard public education program to be implemented annually.

Objective 2.2: Encourage citizens to observe and report potential hazard events.

GOAL #3: Maximize the impact of public resources through effective coordination and the efficient use of technology.

Objective 3.1: Establish regional GIS coordination.

Objective 3.2: Establish a minimum standard for GIS capabilities and data.

GOAL #4: Improve and enhance emergency management capabilities.

Objective 4.1: Improve Regional Level of Warning System Capabilities.

Objective 4.2: Improve Regional Coordination.

Action Plan

The Action Plan presents the prioritized recommendations for the RADCO region and individual jurisdictions to pursue in order to lessen the vulnerability of people, property, infrastructure, and natural and cultural resources to future disaster losses.

In order to assist the individual jurisdictions in the RADCO region with the identification of specific projects to mitigate the impacts of natural hazards, all of the action item information assembled at previous HMPC meetings was organized within the framework of the identified goals and objectives. The consultant facilitated a meeting of the HMPC to review these regional and individual community action items. After this review, the consultant broke the planning committee into community specific working groups. Each of these small working groups then reviewed the roster of regional and individual actions in order to test their relevance to each jurisdiction. Participants were encouraged to use the items from the regional list as appropriate. They were also encouraged to establish other actions or project-worthy activities that did not surface in the discussion of regional mitigation actions and strategies.

Participants were given the FEMA/VDEM Recommended Mitigation Action Form (RMAF) for guidance during this exercise. This form asks the user to establish some very basic, but important, information for use in the mitigation project identification and implementation process, including:

- Issue/Background Statement;
- Recommended Action Item;
- Responsible Office/Person;
- Priority;
- Cost Estimate;
- Community Benefit;
- Potential Funding; and
- Schedule.

At the conclusion of the planning session, the consultant tallied the results for each community, with information based on the RMAF categories. All of the action information assembled was scored by the HMPC to help prioritize, on a regional basis, the mitigation actions seen as most important and/or applicable to the region. HMPC members were each given a total of nine votes (three red dots representing five points, three yellow dots representing three points, and three blue dots, representing one point) and were asked to choose among the mitigation actions identified. HMPC members were allowed to use as many of their votes as they chose on any mitigation action recommendation or to spread them among multiple recommendations. They were allowed to trade votes, or otherwise negotiate with any other committee members, and were not required to use all of their votes.

The action items recommended and prioritized by the HMPC are presented in order of priority to the region both in terms of need and effectiveness. The recommended action items are also listed under the corresponding developed goal. Each action item includes a cost estimate and community benefit to meet the regulatory requirements of DMA. Action items that were considered, but not recommended, are included at the end of this section.

7.1 Regional Recommended Action Items

GOAL #1: Reduce the future impacts and losses from identified hazards.

Objective 1.1: Develop a coordinated set of mitigation actions that address the following specific hazards:
d. Flooding;
e. Wildfires; and
f. Severe Weather (tornadoes, winter storms, northeasters, and hurricanes).
Objective 1.2: Protect critical facilities.

REGIONAL RECOMMENDED ACTION 1:

The National Flood Insurance Program (NFIP) is a Federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages.

It is recommended for all jurisdictions currently participating in the National Flood Insurance Program (NFIP) remain compliant.

Responsible Office:	Local Floodplain Management Official; Emergency Management Officials
Priority (H, M, L):	High
Cost Estimate:	Staff coordination time
Community Benefit:	Reduced flood damages; Life-Safety
Potential funding:	Existing Budgets
Schedule:	Annually

Additional regional action items were not recommended by the HMPC for Goal #1 and the associated objectives to develop hazard specific mitigation actions and to protect critical facilities. See Sections 7.2.1 through 7.2.5 for community-specific recommended action items.

GOAL #2: Educate and engage the public regarding hazards, their impacts, and feasible actions.

Objective 2.1: Develop a seasonal multi-hazard public education program to be implemented annually.
Objective 2.2: Encourage citizens to observe and report potential hazard events.

REGIONAL RECOMMENDED ACTION 2:

It is recommended to develop and conduct a multi-hazard, seasonal Public Awareness Program that provides citizens and businesses with accurate information describing the risk and vulnerability to natural hazards, and is implemented on an annual basis.

The RADCO Region is subject to several natural hazards, each which poses a different degree of risk and associated vulnerability. Some hazards have a combination of attributes, including a high likelihood of occurrence, a specific location that is likely to be affected, and proven approaches that can reduce the impact; therefore the HMPC has recommended that specific actions be taken in regards to these hazards.

For other hazards, where either the likelihood of occurrence is very low, or the area of likely impact cannot be specified, or there is very little that can be done to reduce the impacts of the hazard, the HMPC has determined that the best approach would simply be to raise public awareness. An educational program for the communities should include information describing historical events and losses, the likelihood of future occurrences, the range of possible impacts, appropriate actions citizens can take to save lives and minimize property damage, and resources for additional information. Any information provided through this effort should be accurate, specific, timely, and consistent with current and accepted local emergency management procedures.

In order to implement a Public Awareness Program, the following actions are recommended:

- Establish a Public Information Committee with the responsibility for developing a Public Awareness Program highlighting the following topics:
    - Wind mitigation techniques such as safe rooms, securing of roofs and foundations, and strengthening garage doors;
    - Information on flood hazards and flood insurance;
    - Winter storm tips including driving and emergency preparedness kits; and
    - Wildfire safety and emergency preparedness.
- Use a variety of information outlets including local news media, distribution of brochures and leaflets, water bill inserts, websites, and public service announcements. Current brochures and flyers should be put on display in office buildings, libraries, and other public places. In addition, information should be linked to billing e-payments.
- Develop public-private partnerships and incentives to support public education activities, including displaying hazard models at schools, Home Depot, Lowes, Homebuilder shows, Realtor organizations, and other events and locations.
- Investigate opportunities to cooperate with Realtor Associations in preparing the public information program strategy. Possibilities include developing a real estate agents' brochure or a process whereby real estate agents disclose hazard information to potential property purchasers, for example through the listing services.
- Continue all public information activities currently taking place. Review effectiveness and revise accordingly.

Responsible Office:	Local Public Information Officers; Emergency Management Officals; RADCO
Priority (H, M, L):	High
Cost Estimate:	$5-20,000, depending upon printing and mailing costs, level of volunteer participation, and scope and frequency of events.
Community Benefit:	Life-Safety, Relatively Low Cost, Multi-Hazard program is efficient
Potential funding:	5% state set aside from future HMGP funding and PDM funds
Schedule:	Part of a seasonal multi-hazard public awareness campaign

Regional action items were not recommended by the HMPC for Goal #2: Objective 2.1 and the associated objective to encourage citizens to observe and report potential hazard events. See Sections 7.2.1 through 7.2.5 for community-specific recommended action items.

GOAL #3: Maximize the impact of public resources through effective coordination and the efficient use of technology.

Objective 3.1: Establish regional GIS coordination.
Objective 3.2: Establish a minimum standard for GIS capabilities and data.

REGIONAL RECOMMENDED ACTION 3:

The RADCO regional jurisdictions currently have varying types and levels of mapping and GIS data. As the communities add GIS to their hazard mitigation capabilities at an established minimum standard, it would be beneficial for the communities to share data and assist in the regional assessment of hazard risk and vulnerability.

It is recommended to establish a clearinghouse of GIS data for all RADCO jurisdictions. This will allow all jurisdictions to have access to compatible data in order to better assess the region and each community's vulnerability to the natural hazards identified in this plan.

Responsible Office:	RADCO; local GIS/IT staff; local Planning Departments
Priority (H, M, L):	Medium
Cost Estimate:	Staff coordination time; possibly software and hardware purchases
Community Benefit:	Spatial planning for mitigation education and programming in identified hazards areas
Potential funding:	RADCO; Existing Budgets; Grant funding
Schedule:	Within 5 years

REGIONAL RECOMMENDED ACTION 4:

GIS capability currently varies between each of the RADCO jurisdictions. However, all jurisdictions are aware of the capability of GIS to assist in the evaluation of risk posed to a community from a variety of natural hazards. Additionally, a GIS system can assist with automation of notification to certain property owners of potential risks from natural hazards through targeted mailing campaigns.

It is recommended to establish a minimum standard for GIS capabilities and data throughout the RADCO region as jurisdictions begin to add GIS to their current hazard mitigation capabilities.

Responsible Office:	RADCO; local GIS/IT staff; local Planning Departments
Priority (H, M, L):	Medium
Cost Estimate:	Staff coordination time; possibly software and hardware purchases Development of GIS working committee.
Community Benefit:	Spatial planning for mitigation education and programming in identified hazards areas
Potential funding:	RADCO; Existing Budgets: Grant funding
Schedule:	Within 5 years

GOAL #4: Improve and enhance emergency management capabilities.

Objective 4.1: Improve Regional Level of Warning System Capabilities.
Objective 4.2: Improve Regional Coordination.

REGIONAL RECOMMENDED ACTION 5:

An early warning system will allow residents to prepare for hazards and take cover in protected areas. The RADCO region has the potential to be significantly impacted not only by natural hazards, such as flooding along the Rappahannock, Potomac, and Rapidan Rivers, but also to be impacted by the North Anna Nuclear Power Station. The power station already has in place an audio warning system (siren) for emergencies. For other potential hazards, development of early warning systems, such as river gauging and flood warning systems, could provide more notice to citizens of impending dangers. Adding automation and warning systems will allow for much more timely warnings for citizens.

It is recommended to establish an early warning system, such as river gauging and flood warning systems, for jurisdictions in the RADCO region that can provide event-distinct information to citizens and businesses.

Responsible Party:	Emergency Management Officials; VDEM
Priority (H,M,L):	High
Cost Estimate:	Dependent on the type and amount of equipment necessary to capture and transmit the data.
Community Benefit:	Warning systems allow residents and business owners the opportunity to get themselves, and often valuable belongings, out of harm's way prior to a flood event, thus reducing the size of damage claims, especially on contents of flooded structures.
Potential Funding:	The RADCO region may be able to coordinate with the Virginia Department of Emergency Management for the installation of IFLOWS (Integrated Flood Observing and Warning System) river gauges on regional waterways, including the Rappahannock and Rapidan Rivers.
Schedule:	Within 4 years

REGIONAL RECOMMENDED ACTION 6:

Many motorists in the RADCO region are commuters or tourists who may be unaware of impending local weather conditions. Providing information en-route would assist the traffic flow. Additionally, when a major thoroughfare is blocked due to traffic collisions or fallen debris, alternate routes through the RADCO communities become heavily congested in a short period of time.

It is recommended to improve the flexibility of the transportation network through coordination with the Virginia Department of Transportation (VDOT) and neighboring regions. The following actions were suggested by the HMPC:

- Improve signage along major interstates and thoroughfares with interactive signs, operated by VDOT, to provide hazard warnings, including weather reports during tornado and hurricane events, road closings and blockages. The signs can also alert motorists to call 511 for road conditions, or to tune their radios to the emergency radio station for up-to-date conditions. Suggested locations include I-95 and Routes 1, 3, 17, 301, and 610.

- Investigate emergency lane/shoulder improvements for Emergency Services access on all primary roads.
- Identify and publicize local evacuation routes throughout the region.
- Identify traffic plan/alternate routes due to closures on primary routes such as 1, 3, 17, 301, and 610.
- Coordinate locally with VDOT on updates to VDOT's Regional Transportation Plans.
- Purchase and place into operation AM radio stations along routes to relay emergency information to motorists during a disaster or emergency.
- Facilitate discussions with neighboring regions on traffic flow for emergency service vehicles.

Responsible Party:	Emergency Management Officials; VDOT
Priority (H,M,L):	Medium/High
Cost Estimate:	Depending on the selected mitigation action, cost of signage; staff time and coordination with VDOT; public education
Community Benefit:	Life-Safety; improved evacuation capability; improved emergency services access
Potential Funding:	Existing Budget; VDOT; Homeland Security Grants
Schedule:	Within 4 years

REGIONAL RECOMMENDED ACTION 7:

The establishment of a standard radio frequency would improve communications during times of disaster or mutual aid response. Currently, there is not an efficient method of communication established for use during hazard events, either among the local County and City officials or among the state and its regional neighbors. The Commonwealth of Virginia has seated a State Interoperability Communications Committee to look into the feasibility of developing such a radio system for state agency use in a disaster. The project started six years ago and may not be complete until 2010. Lack of communication not only impedes responders to an emergency, but also can complicate post disaster communications from a mitigation perspective.

It is recommended to investigate the feasibility of establishing a common means of communication, such as one radio frequency or equipment to connect existing radio frequencies, for use by all emergency services departments in the RADCO region.

Responsible Party:	Emergency Management Officials; Communications Supervisors/Directors
Priority (H,M,L):	High
Cost Estimate:	When the state pilot program started six years ago, cost estimates ran upwards of $2 million. No firm cost estimate has been established relating to a County-specific solution.
Community Benefit:	Ease of communication enhances the community's ability to identify potential mitigation opportunities soon after a disaster and may assist local officials efforts to prevent citizens and businesses from being affected as dramatically by the impacts of a natural hazard.
Potential Funding:	Existing Budget; Homeland Security Grants
Schedule:	Ongoing

REGIONAL RECOMMENDED ACTION 8:

The topography of the RADCO region creates gaps in radio communications. The lack of communication could become a problem for communities or emergency responders if a hazard were to strike in these uncovered areas.

It is recommended to investigate and potentially purchase the equipment required to eliminate radio communication gaps in valleys.

Responsible Party:	Emergency Management Officials; Communication Supervisors/Directors; Stafford County has offered to provide a list of radio gap locations.
Priority (H,M,L):	Medium
Cost Estimate:	Staff time to investigate equipment needs; cost of required equipment
Community Benefit:	Ease of communication enhances the community's ability to identify potential mitigation opportunities soon after a disaster and may assist local officials efforts to prevent citizens and businesses from being affected as dramatically by the impacts of a natural hazard.
Potential Funding:	Existing Budget; Homeland Security Grants
Schedule:	Within 5 years

7.2 Community Specific Recommended Action Items

7.2.1 Caroline County, including the Towns of Bowling Green and Port Royal Recommended Action Items

GOAL #1: Reduce the future impacts and losses from identified hazards.

Objective 1.1: Develop a coordinated set of mitigation actions that address the following specific hazards:
- *a. Flooding;*
- *b. Wildfires; and*
- *c. Severe Weather (tornadoes, winter storms, northeasters, and hurricanes).*

Objective 1.2: Protect critical facilities.

RECOMMENDED ACTION 1:

Without a base flood elevation established for the major river bodies located within the County, it is difficult to make adequate, accurate floodplain management decisions. In addition to the potential damage from riverine flooding, tropical systems that have affected the area in recent years have demonstrated the dangers of tidal-induced flooding.

It is recommended to investigate the feasibility of updating the Flood Insurance Studies and Flood Insurance Rate Maps for Caroline County, the Town of Bowling Green, and the Town of Port Royal.

Responsible Party:	Town/County Engineer; FEMA Region III; Study contractor
Priority (H,M,L):	Medium/High
Cost Estimate:	FEMA map modernization program, Region III Study Contract Budget
Community Benefit:	More accurate delineation of the County's and Town's floodplains will allow for better floodplain management and subsequently reduce potential damage from flooding over time.
Potential Funding:	Existing Budget; FEMA map modernization program, Region III Study Contract Budget
Schedule:	Within 5 years

RECOMMENDED ACTION 2:

Caroline County recognizes that while new development in the floodplain is not a widespread concern, pre-existing structures, and especially mobile homes, exist in the community's floodplains and are subject to potential damage from flooding. Proper anchoring can prevent existing mobile homes from floating during a flood, which can prevent more widespread flooding damage related to a floating structure blocking a bridge or major drainage way. Retrofitting/raising existing structures can prevent flooding of existing structures.

It is recommended to ensure proper elevation through retrofit and anchoring of mobile homes and other attendant appurtenances located in the floodplain to reduce the risk of future flood damage.

Responsible Party:	County Building Inspector; Floodplain Manager
Priority (H,M,L):	Medium
Cost Estimate	Capital cost of anchor/foundation; Elevation expenses
Community Benefit:	Prevent repetitive losses
Potential Funding:	PDM and HMGP Funding
Schedule:	Within 5 years

RECOMMENDED ACTION 3:

Severe weather has been identified by the HMPC as a critical hazard for Caroline County and the Towns of Bowling Green and Port Royal. Potential mitigation measures for severe weather may include hurricane clips, safe rooms, and model shelters. Safe rooms are reinforced small rooms built in the interior of a home, which are fortified by concrete and/or steel to offer extra protection against tornadoes, hurricanes and other severe windstorms. Shelters are excellent ideas for apartment complexes, mobile home parks, factories, office complexes and other facilities where large groups of people live and work.

It is recommended to investigate safeguards against severe weather including hurricane clips, safe rooms, community shelters, and/or model shelters.

Responsible Party:	Emergency Management Officials; Building Officials; Private Industry; Citizens
Priority (H,M,L):	Medium
Cost Estimate:	Staff Time
Community Benefit:	Reduced losses, Life-Safety; Public education for residents within the community
Potential Funding:	Existing Budget
Schedule:	Within 3 years

GOAL #2: Educate and engage the public regarding hazards, their impacts, and feasible actions.

Objective 2.1: Develop a seasonal multi-hazard public education program to be implemented annually.
Objective 2.2: Encourage citizens to observe and report potential hazard events

RECOMMENDED ACTION 4:

It is recommended to develop a Regional Public Awareness Program.

See Regional Recommended Action 2.

GOAL #3: Maximize the impact of public resources through effective coordination and the efficient use of technology.

Objective 3.1: Establish regional GIS coordination.
Objective 3.2: Establish a minimum standard for GIS capabilities and data.

RECOMMENDED ACTION 5:

Caroline County and the Town of Bowling Green do not currently have GIS capabilities. GIS capabilities can assist the County and Town in evaluating the risk posed to certain properties from a variety of natural hazards. GIS can also assist with automation of notification to certain property owners of potential risks from natural hazards through targeted mailing campaigns. A needs assessment will prepare the County and Town of Bowling Green for GIS implementation, including the development and/or conversion of existing planimetric and topographic data.

It is recommended to initiate a GIS needs assessment and program.

Responsible Party:	Planning; Emergency Management; RADCO
Priority (H,M,L):	High

Cost Estimate:	Staff Time; Hardware and software
Community Benefit:	The implementation of a GIS system will offer the data management and query capability to help target mitigation education and programming to those parcels that are subject to the hazards that have been outlined in this plan.
Potential Funding:	Existing Budget; Homeland Security Grants
Schedule:	Within 5 years

RECOMMENDED ACTION 6:

It is recommended to establish a minimum standard for GIS capabilities and data throughout the RADCO region as jurisdictions begin to add GIS to their current hazard mitigation capabilities.

See Regional Recommended Action 3.

RECOMMENDED ACTION 7:

It is recommended to establish a clearinghouse of GIS data for all RADCO jurisdictions. This will allow all jurisdictions to have access to compatible data in order to better assess the region and each community's vulnerability to the natural hazards identified in this plan.

See Regional Recommended Action 4.

GOAL #4: Improve and enhance emergency management capabilities.

Objective 4.1: Improve Regional Level of Warning System Capabilities.
Objective 4.2: Improve Regional Coordination.

RECOMMENDED ACTION 8:

It is recommended to establish an early warning system for jurisdictions in the RADCO region that can provide event-distinct information to citizens and businesses.

See Regional Recommended Action 5.

RECOMMENDED ACTION 9:

It is recommended to improve the flexibility of the transportation network through coordination with the Virginia Department of Transportation (VDOT) and neighboring regions.

See Regional Recommended Action 6.

RECOMMENDED ACTION 10:

It is recommended to investigate the feasibility of establishing a common means of communication, such as one radio frequency or equipment to connect existing radio frequencies, for use by all emergency services departments in the RADCO region.

See Regional Recommended Action 7.

RECOMMENDED ACTION 11:

It is recommended to investigate and potentially purchase the equipment required to eliminate radio communication gaps in valleys.

See Regional Recommended Action 8.

7.2.2 King George County Recommended Action Items

GOAL #1: Reduce the future impacts and losses from identified hazards.

Objective 1.1: Develop a coordinated set of mitigation actions that address the following specific hazards:
a. Flooding;
b. Wildfires; and
c. Severe Weather (tornadoes, winter storms, northeasters, and hurricanes).
Objective 1.2: Protect critical facilities.

RECOMMENDED ACTION 1:

The County's current FIRM panels contain outdated information. FEMA Region III has designated all communities within the Commonwealth of Virginia for the development of a Digital Flood Insurance Rate Maps and associated geo-databases, which will provide King George County with a management tool for the community's floodplains.

It is recommended to assist the Study Contractor in preparing revised Digital Flood Insurance Rate Maps (FIRMs) by identifying areas within the community, that flood frequently, and are not reflected appropriately on the existing FIRMs. Additionally, providing GIS capabilities and upcoming aerial photography (Spring 2006) will generate more accurate floodplains.

Responsible Party:	FEMA Region III and flood study contractor; Emergency Management; Community Development
Priority (H,M,L):	High
Cost Estimate:	FEMA map modernization program, Region III Study Contract Budget
Community Benefit:	More accurate delineation of the County's floodplains will allow for better floodplain management and subsequently reduce potential damage from flooding over time.
Potential Funding:	Existing Budget; FEMA map modernization program, Region III Study Contract Budget
Schedule:	Within 3 years

RECOMMENDED ACTION 2:

It is recommended to update the County Ordinance and Zoning to prohibit construction of large occupancy structures within identified hazard areas, such as floodplains or areas adjacent to hazardous materials (Tier II) facilities. Current Regional Standards include: Spotsylvania County (residential structures prohibited in the floodplain; commercial structures by special permit only) and Stafford County (structures must be built to the base flood elevation plus 3 feet).

Responsible Party:	Emergency Management; Community Development; Building Officials; BOS
Priority (H,M,L):	High
Cost Estimate:	Staff Time to develop ordinance
Community Benefit:	Reduced losses, Life-safety
Potential Funding:	Existing Budget
Schedule:	Within 2 years

RECOMMENDED ACTION 3:

The current floodplain ordinance for King George County requires the first floor elevation of structures constructed in the floodplain to be at the base flood elevation. By requiring this first floor elevation to be higher, the potential for flood damage will be reduced.

It is recommended to update the existing floodplain ordinance to require first floor elevations in the floodplain to be constructed at the base flood elevation plus 2 feet.

Responsible Party:	Community Development; County Engineer
Priority (H,M,L):	Medium
Cost Estimate	Costs will include staff time for the development of the ordinance and proper public hearing and notice prior to action by the Board of Supervisors.
Community Benefit:	Reduce potential damage from flooding
Potential Funding:	Existing Budget
Schedule:	Within 5 years

RECOMMENDED ACTION 4:

Many older homes in the area may be at risk for fire damage due to insufficient tree and propane tank setback distances. Fire hydrants may be located too far away from homes, reducing their effectiveness. In addition, many current residences have narrow driveways that are very difficult for emergency vehicles to access.

It is recommended to develop and adopt development design standards based upon FIREWISE principles into a subdivision ordinance. The design standards should include standard setbacks from trees and above-ground propane tanks, and minimum distances from fire hydrants. FIREWISE recommended building materials should also be specified.

Responsible Party:	Community Development; County Engineer; VA Department of Forestry
Priority (H,M,L):	Low
Cost Estimate	Costs will include staff time for the development of the standards to incorporate into the subdivision ordinance and proper public hearing and notice prior to action by the Board of Supervisors.
Community Benefit:	Incorporation of the FIREWISE principles in new and re-development projects throughout the County will, over time, decrease the likelihood of insured fire damage from wildfire.
Potential Funding:	Existing Budget
Schedule:	Within 5 years

RECOMMENDED ACTION 5:

Critical facilities are the community's assets that are the most important or vital to emergency management functions. Critical facilities warrant special attention in preparing for a disaster and are of vital importance to maintaining citizen life, health, and safety during and/or directly after a disaster event.

It is recommended to ensure that all new construction of critical facilities (schools/shelters; public safety facilities; County buildings; and water and sewer facilities) exceeds requirements for sustainability during a disaster. Additionally, ensure all new construction of critical facilities includes hurricane shutters and straps, safe rooms, fire walls, and sprinkler systems.

Responsible Party:	Emergency Management; Building Official; Community Development; BOS; Service Authority
Priority (H,M,L):	High
Cost Estimate:	Cost estimates will vary based on the measures identified and the facilities' respective conditions and locations.
Community Benefit:	Continued viability of critical infrastructure before, during, and after a disaster can decrease potential losses or property damage that would only be exacerbated by loss of these critical functions.
Potential Funding:	Cost should be included in the cost of new construction. Grant funding for the protection of wastewater facilities is available from the Environmental Protection Agency through such programs as the Clean Water State Revolving Fund (CWSRF)
Schedule:	Ongoing

RECOMMENDED ACTION 6:

King George County noted power generation as a key component of providing services during and after a disaster. Critical infrastructure to be considered includes water and sewer system operability, transportation infrastructure integrity, and the integrity of other municipal facilities, such as the County's Emergency Operations Center (EOC).

It is recommended to identify priorities for protection among critical facilities identified in the plan as well as methods for protection against natural hazards, including the retrofitting of structures for quick external power generator hook up and purchasing required generators for critical facilities.

Responsible Party:	Emergency Management; County Engineer; Service Authority
Priority (H,M,L):	High
Cost Estimate:	Cost estimates will vary based on the measures identified and the specific facilities' respective conditions and locations.
Community Benefit:	Continued viability of critical infrastructure before, during, and after a disaster can decrease potential losses of life or property damage that would only be exacerbated by loss of these critical functions.
Potential Funding:	Grant funding for the protection of wastewater facilities is available from the Environmental Protection Agency through such programs as the CWSRF. Retrofitting of facilities for quick external power generator hook up has been classified as an acceptable mitigation activity for the HMGP and PDM grant programs.
Schedule:	Within 2 years

RECOMMENDED ACTION 7:

Severe weather has been identified by the HMPC as critical hazard for King George County. Potential mitigation measures for severe weather may include safe rooms and community shelters. Safe rooms are reinforced small rooms built in the interior of a home, which are fortified by concrete and/or steel to offer extra protection against tornadoes, hurricanes and other severe windstorms. Community shelters are excellent ideas for apartment complexes, mobile home parks, factories, office complexes and other facilities where large groups of people live, work or study.

It is recommended to research the possibility of a County ordinance that requires future development of mobile home parks to include a community shelter for citizen protection in the event of a disaster or emergency. Ordinances should also strongly suggest other shelter facilities.

Responsible Party:	Emergency Management; Community Development; Building Officials
Priority (H,M,L):	Medium
Cost Estimate:	Staff Time to develop ordinance
Community Benefit:	Reduced losses, Life-safety
Potential Funding:	Existing Budget
Schedule:	Within 3 years

GOAL #2: Educate and engage the public regarding hazards, their impacts, and feasible actions.

Objective 2.1: Develop a seasonal multi-hazard public education program to be implemented annually.
Objective 2.2: Encourage citizens to observe and report potential hazard events

RECOMMENDED ACTION 8:

It is recommended to develop a Regional Public Awareness Program.

See Regional Recommended Action 2.

RECOMMENDED ACTION 9:

King George County currently uses the KGALERT system to contact citizens during a major crisis or emergency. KGALERT delivers emergency alerts, notifications and updates to citizens on a variety of communication formats:

- Email
- Cell phone
- Pager
- Blackberry device
- Palm pilot and/or PDA

It is recommended to continue the use of KGALERT to distribute preparedness information.

Responsible Party:	Emergency Management
Priority (H,M,L):	Medium
Cost Estimate:	Staff time; Equipment support
Community Benefit:	Early warning notification; Life-Safety
Potential Funding:	Existing Budget
Schedule:	Ongoing

RECOMMENDED ACTION 10:

In addition to KGALERT, King George County recognizes the need to provide non-emergency information to citizens during a disaster.

It is recommended to develop a "hotline" for citizens to call for non-emergency information during a disaster.

Responsible Party:	Emergency Management; Public Information Officer
Priority (H,M,L):	Medium
Cost Estimate:	Staff time; Equipment support
Community Benefit:	Early warning notification; Life-Safety
Potential Funding:	Existing Budget
Schedule:	Ongoing

RECOMMENDED ACTION 11:

King George County noted power generation as a key component of providing services during and after a disaster. Not only are generators beneficial to critical facilities during emergency situations, generators are beneficial to home owners, as well.

It is recommended to provide educational material and recommend the installation of home generators to the public and local contractors and builders for all new construction.

Responsible Party:	Emergency Management; Community Development; Building Official
Priority (H,M,L):	Medium
Cost Estimate:	Staff time; Advertisement
Community Benefit:	Life-Safety
Potential Funding:	Exiting Budget
Schedule:	Ongoing

RECOMMENDED ACTION 12:

The HMPC representatives for King George County identified dam failure as a non-critical hazard with low probability of occurrence. However, dams are located within the community and preparedness for dam failure remains an important mitigation measure.

It is recommended to implement citizen notification of potential for dam failures.

Responsible Party:	Emergency Management; Community Development
Priority (H,M,L):	Medium
Cost Estimate:	Staff Time
Community Benefit:	Reduced losses, Life-safety
Potential Funding:	Existing Budget
Schedule:	Within 2 years

GOAL #3: Maximize the impact of public resources through effective coordination and the efficient use of technology.

Objective 3.1: Establish regional GIS coordination.
Objective 3.2: Establish a minimum standard for GIS capabilities and data.

RECOMMENDED ACTION 13:

It is recommended to establish a minimum standard for GIS capabilities and data throughout the RADCO region as jurisdictions begin to add GIS to their current hazard mitigation capabilities.

See Regional Recommended Action 4.

RECOMMENDED ACTION 14:

It is recommended to establish a clearinghouse of GIS data for all RADCO jurisdictions. This will allow all jurisdictions to have access to compatible data in order to better assess the region and each community's vulnerability to the natural hazards identified in this plan.

See Regional Recommended Action 4.

RECOMMENDED ACTION 15:

Aerial photography is useful for hazard identification and disaster preparedness purposes.

It is recommended to provide additional money to Community Development for the aerial photography to be created from the County flyover in Spring 2006, to improve disaster preparedness capability.

Responsible Party:	Emergency Management; Community Development
Priority (H,M,L):	Medium
Cost Estimate:	Approximately $12,000
Community Benefit:	Improved identification of hazard areas; improved GIS data; improved floodplain identification
Potential Funding:	Exiting Budget; Grant funding
Schedule:	Within 1 year

GOAL #4: Improve and enhance emergency management capabilities.

Objective 4.1: Improve Regional Level of Warning System Capabilities.
Objective 4.2: Improve Regional Coordination.

RECOMMENDED ACTION 16:

It is recommended to establish an early warning system for jurisdictions in the RADCO region that can provide event-distinct information to citizens and businesses.

See Regional Recommended Action 5.

RECOMMENDED ACTION 17:

It is recommended to improve the flexibility of the transportation network through coordination with the Virginia Department of Transportation (VDOT) and neighboring regions.

See Regional Recommended Action 6.

RECOMMENDED ACTION 18:

It is recommended to investigate the feasibility of establishing a common means of communication, such as one radio frequency or equipment to connect existing radio frequencies, for use by all emergency services departments in the RADCO region.

See Regional Recommended Action 7.

RECOMMENDED ACTION 19:

It is recommended to investigate and potentially purchase the equipment required to eliminate radio communication gaps in valleys.

See Regional Recommended Action 8.

7.2.3 City of Fredericksburg Recommended Action Items

GOAL #1: Reduce the future impacts and losses from identified hazards.

Objective 1.1: Develop a coordinated set of mitigation actions that address the following specific hazards:
- *a. Flooding;*
- *b. Wildfires; and*
- *c. Severe Weather (tornadoes, winter storms, northeasters, and hurricanes).*

Objective 1.2: Protect critical facilities.

RECOMMENDED ACTION 1:

The City has approximately 300 parcels affected by the currently mapped floodplain. In addition, the City has four properties that appear on FEMA's repetitive loss list for having filed two flood insurance claims of $1,000 or more in a ten-year period. Mitigation of repetitive flood losses is FEMA's top mitigation priority. If the City's repetitive loss property owners are interested in an approved mitigation measure (i.e. relocation of the structure, elevation in place, buy-out, flood proofing [if a non-residential structure]), funding for such activity can come from a variety of sources. Projects may have to pass a benefit-cost analysis.

It is recommended to investigate the feasibility of mitigating the City's repetitive loss structures from future flooding events.

Responsible Party:	Planning/Building, Emergency Management in conjunction with the Virginia Department of Emergency Management
Priority (H,M,L):	High
Cost Estimate	Cost will depend on the mitigation method chosen.
Community Benefit:	Elevating, removing, or otherwise mitigating a structure greatly reduces the chances for future damage from flooding. Mitigation of repetitive loss structures is FEMA's top priority for mitigation funding.
Potential Funding:	Potential funding sources include the HMGP and PDM programs. Potential matching fund sources include the property owners themselves and the City, potentially in conjunction with the Commonwealth.
Schedule:	Within 2 years

RECOMMENDED ACTION 2:

Flooding studies are often inaccurate, and alterations in the natural floodplain can lead to hydrologic and hydraulic changes downstream

It is recommended to investigate the potential to include a provision in the floodplain management ordinance that any project that requires the placement of fill in the floodplain will be required to provide 110 percent compensatory floodplain storage.

Responsible Party:	Planning and Zoning, Building and Development Services
Priority (H,M,L):	Low
Cost Estimate:	Costs will include staff time for the development of ordinance language and proper public hearing and notice prior to action by the City Council.
Community Benefit:	The risk of future flood damage for those properties will be significantly reduced.

Potential Funding:	Potential funding sources include the Flood Mitigation Assistance Program's (FMA) Planning Grant; County General Fund revenues.
Schedule:	Within 5 years

RECOMMENDED ACTION 3:

The City's current FIRM panels contain outdated information. FEMA Region III has designated the City of Fredericksburg for the development of a Digital Flood Insurance Rate Map geo-database in 2005-2006, which will allow for the introduction of the City's floodplain data from the original flood study into the database that FEMA has developed to eventually provide an automated management tool for the community's floodplains. The FY 2006 study funding may include re-delineation of the floodplain boundaries in the City, which City officials have described as inaccurate.

It is recommended to assist the Study Contractor in preparing revised Digital Flood Insurance Rate Maps (FIRMs) by identifying areas within the community, which flood frequently and are not reflected appropriately on the existing FIRMs. Additionally, provide available digital data.

Responsible Party:	FEMA Region III and flood study contractor
Priority (H,M,L):	High
Cost Estimate:	FEMA map modernization program, Region III Study Contract Budget
Community Benefit:	More accurate delineation of the City's floodplains will allow for better floodplain management and subsequently reduce potential damage from flooding over time.
Potential Funding:	FEMA map modernization program, Region III Study Contract Budget
Schedule:	Within 3 years

RECOMMENDED ACTION 4:

The National Flood Insurance Program's Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: reduce flood losses; facilitate accurate insurance rating; and promote the awareness of flood insurance.

It is recommended to investigate participation in the Community Rating System.

Responsible Party:	Planning and Community Development
Priority (H,M,L):	Medium
Cost Estimate:	Staff Time
Community Benefit:	Reduced cost of flood insurance for community residents.
Potential Funding:	Existing Budget
Schedule:	Within 3 years

RECOMMENDED ACTION 5:

Many older homes in the area may be at risk for fire damage due to insufficient tree and propane tank setback distances. Fire hydrants may be located too far away from homes, reducing their effectiveness. In addition, many current residences have narrow driveways that are very difficult for emergency vehicles to access.

It is recommended to develop and adopt development design standards based upon FIREWISE principles into the City's subdivision ordinance. The design standards should include standard setbacks

from trees and above-ground propane tanks, and minimum distances from fire hydrants. FIREWISE recommended building materials should also be specified.

Responsible Party:	Planning and Zoning, Public Works
Priority (H,M,L):	Low
Cost Estimate	Costs will include staff time for the development of the standards to incorporate into the Subdivision ordinance and proper public hearing and notice prior to action by the City Council.
Community Benefit:	Incorporation of the FIREWISE principles in new and re-development projects throughout the City will, over time, decrease the likelihood of insured fire damage from wildfire.
Potential Funding:	Existing Budget
Schedule:	Within 5 years

RECOMMENDED ACTION 6:

Severe weather has been identified by the HMPC as critical hazard for the City of Fredericksburg. Potential mitigation measures for severe weather may include hurricane clips, safe rooms, and model shelters. Safe rooms are reinforced small rooms built in the interior of a home, which are fortified by concrete and/or steel to offer extra protection against tornadoes, hurricanes and other severe windstorms. Shelters are excellent ideas for apartment complexes, schools, mobile home parks, factories, office complexes and other facilities where large groups of people live, work or study.

It is recommended to investigate safeguards against severe weather including hurricane clips, safe rooms, community shelters, and/or model shelters.

Responsible Party:	Emergency Management Officials
Priority (H,M,L):	Medium
Cost Estimate:	Staff Time
Community Benefit:	Reduced losses, Life-Safety; Public education for residents within the community
Potential Funding:	Existing Budget
Schedule:	Within 3 years

RECOMMENDED ACTION 7:

Severe weather has been identified by the HMPC as critical hazard for the City of Fredericksburg. A potential mitigation measure for severe weather includes warning systems.

It is recommended to investigate warning systems for severe weather.

Responsible Party:	Emergency Management Officials
Priority (H,M,L):	High
Cost Estimate:	Staff Time
Community Benefit:	Improved warning, increased lead time on warning systems and mitigation efforts, reduced losses, Life-Safety
Potential Funding:	Homeland Security Grant
Schedule:	Within 1 year

RECOMMENDED ACTION 8:

Critical facilities are the community's assets that are the most important or vital to emergency management functions. Critical facilities warrant special attention in preparing for a disaster and are of vital importance to maintaining citizen life, health, and safety during and/or directly after a disaster event. Identifying these facilities using the community's GIS capabilities will allow for spatial analysis with hazard areas and improved community planning.

It is recommended to identify all critical facilities using GIS.

Responsible Party:	Public Works
Priority (H,M,L):	High
Cost Estimate:	Staff time
Community Benefit:	Critical facility protection
Potential Funding:	Existing Budget
Schedule:	Within 2 years

RECOMMENDED ACTION 9:

The City noted power generation as a key component of providing services during and after a disaster. Other critical infrastructure to be considered includes water and sewer system operability, transportation infrastructure integrity, and the integrity of other municipal facilities, such as the City's Emergency Operations Center (EOC).

It is recommended to identify priorities for protection among critical facilities identified in the plan as well as methods for protection against natural hazards, including the retrofitting of structures for quick external power generator hook up.

Responsible Party:	Emergency Management Officials
Priority (H,M,L):	Medium/High
Cost Estimate:	Cost estimates will vary based on the measures identified and the facilities' respective conditions and locations.
Community Benefit:	Continued viability of critical infrastructure before, during, and after a disaster can decrease potential losses or property damage that would only be exacerbated by loss of these critical functions.
Potential Funding:	Grant funding for the protection of wastewater facilities is available from the Environmental Protection Agency. Retrofitting of facilities for quick external power generator hook up has been classified as an acceptable mitigation activity for the HMGP and PDM grant programs.
Schedule:	Within 2 years

GOAL #2: Educate and engage the public regarding hazards, their impacts, and feasible actions.

Objective 2.1: Develop a seasonal multi-hazard public education program to be implemented annually.
Objective 2.2: Encourage citizens to observe and report potential hazard events

RECOMMENDED ACTION 10:

It is recommended to develop a Regional Public Awareness Program.

See Regional Recommended Action 2.

RECOMMENDED ACTION 11:

The Community Emergency Response Team (CERT) Program educates people about disaster preparedness for hazards that may impact their area and trains them in basic disaster response skills, such as fire safety, light search and rescue, team organization, and disaster medical operations. Using the training learned in the classroom and during exercises, CERT members can assist others in their neighborhood or workplace following an event when professional responders are not immediately available to help.

An additional option for public involvement includes weather spotting. Weather Spotters provide invaluable assistance and critical information to decision makers when hazardous weather threatens the community. Countless lives have been saved because of this unique partnership between volunteer storm spotters, emergency management and the National Weather Service.

It is recommended to continue the CERT Training and Weather Spotter Training programs currently in place within the City.

Responsible Party:	Emergency Management Officials
Priority (H,M,L):	Medium
Cost Estimate:	Staff Time for Training
Community Benefit:	Life-Safety
Potential Funding:	Existing Budget; Grant funding
Schedule:	Annually

RECOMMENDED ACTION 12:

Neighborhood Watch groups, in conjunction with local officials and law enforcement agencies, have historically worked to address crime prevention issues. An additional benefit is to assist local residents become a critical element in the detection and prevention of disruptions caused by a hazard event.

It is recommended to investigate the development of a community based emergency contact network.

Responsible Party:	Emergency Management Officials
Priority (H,M,L):	Medium
Cost Estimate:	Volunteer and Staff Time
Community Benefit:	Life-Safety
Potential Funding:	Volunteer Time; Existing Budget
Schedule:	Within 5 years

GOAL #3: Maximize the impact of public resources through effective coordination and the efficient use of technology.

Objective 3.1: Establish regional GIS coordination.
Objective 3.2: Establish a minimum standard for GIS capabilities and data.

RECOMMENDED ACTION 13:

The City does not currently have a GIS capability, but GIS capabilities can assist the City in evaluating the risk posed to certain properties from a variety of natural hazards. GIS can also assist with automation of notification to certain property owners of potential risks from natural hazards through targeted mailing campaigns. The City has begun a GIS needs assessment that should be completed in the summer of 2005. Once the needs assessment has been completed, the City will have the information necessary to move towards implementation, including the development and/or importation of planimetric and topographic data.

It is recommended to establish a minimum level of GIS data for the City.

Responsible Party:	City Planner; City Engineer
Priority (H,M,L):	High
Cost Estimate:	Software and Hardware Costs; Staff Training; Staff Time
Community Benefit:	The implementation of a City GIS will offer the data management and query capability to help target mitigation education and programming to those parcels that are subject to the hazards that have been outlined in this plan.
Potential Funding:	Needs assessment project has been funded through the City's General Fund and a grant that has been acquired by the City's transit authority
Schedule:	Following the completion of the Needs Assessment.

RECOMMENDED ACTION 14:

It is recommended to establish a clearinghouse of GIS data for all RADCO jurisdictions. This will allow all jurisdictions to have access to compatible data in order to better assess the region and each community's vulnerability to the natural hazards identified in this plan.

See Regional Recommended Action 3.

GOAL #4: Improve and enhance emergency management capabilities.

Objective 4.1: Improve Regional Level of Warning System Capabilities.
Objective 4.2: Improve Regional Coordination.

RECOMMENDED ACTION 15:

It is recommended to establish an early warning system for jurisdictions in the RADCO region that can provide event-distinct information to citizens and businesses.

See Regional Recommended Action 5.

RECOMMENDED ACTION 16:

It is recommended to improve the flexibility of the transportation network through coordination with the Virginia Department of Transportation (VDOT) and neighboring regions.

See Regional Recommended Action 6.

RECOMMENDED ACTION 17:

It is recommended to investigate the feasibility of establishing a common means of communication, such as one radio frequency or equipment to connect existing radio frequencies, for use by all emergency services departments in the RADCO region.

See Regional Recommended Action 7.

RECOMMENDED ACTION 18:

It is recommended to investigate and potentially purchase the equipment required to eliminate radio communication gaps in valleys.

See Regional Recommended Action 8.

7.2.4 Spotsylvania County Recommended Action Items

GOAL #1: Reduce the future impacts and losses from identified hazards.

Objective 1.1: Develop a coordinated set of mitigation actions that address the following specific hazards:
a. Flooding;
b. Wildfires; and
c. Severe Weather (tornadoes, winter storms, northeasters, and hurricanes).
Objective 1.2: Protect critical facilities.

RECOMMENDED ACTION 1:

Flooding studies are often inaccurate, and alterations in the natural floodplain can lead to hydrologic and hydraulic changes downstream

It is recommended to investigate the need to include a provision in the floodplain management ordinance that any project that requires the placement of fill in the floodplain will be required to provide 110 percent compensatory floodplain storage.

Responsible Party:	Code Compliance
Priority (H,M,L):	High
Cost Estimate:	Costs will include staff time for the development of ordinance language and proper public hearing and notice prior to action by the County Board of Supervisors.
Community Benefit:	Reduction in future flood damage
Potential Funding:	Existing Budget
Schedule:	Within 2 years

RECOMMENDED ACTION 2:

Minimum Standard 19 (MS-19) is a site-by-site approach to stormwater management designed to ensure an adequate receiving channel for stormwater runoff from individual development projects. The primary purpose of MS-19 is to ensure that downstream properties are not adversely affected. This approach to stormwater management is relatively effective in areas that are not experiencing intense development pressure. However, in areas that are experiencing dense development, MS-19 is not as effective, largely because the cumulative impacts on a single receiving stream can lead to channel deterioration, flooding, and much higher peak flow velocities. The erosion caused by the increase in velocity can cause surface water quality to significantly deteriorate. As stream banks destabilize, streams become sediment-laden, turbidity increases, nutrient loading occurs, and submerged aquatic vegetation and biota suffer.

It is recommended to develop a comprehensive local stormwater management ordinance that provides water quality protection that could compensate for loopholes in related state erosion and sediment control laws, such as the 1 percent loophole noted in Minimum Standard 19 of the Virginia Erosions and Sediment Control Law and Regulations.

Responsible Party:	Code Compliance
Priority (H,M,L):	High
Cost Estimate:	Costs will include staff time for the development of ordinance language and proper public hearing and notice prior to action by the County Board of Supervisors. Model ordinance language is available from the Virginia Department of Conservation and Recreation (VDCR).

Community Benefit:	By managing stormwater proactively and requiring a comprehensive look at the impact that new and re-development projects will have on local drainage components, the County will be able to avoid nuisance drainage problems that over time can grow into more serious flooding events.
Potential Funding:	Existing Budget
Schedule:	Within 2 years

RECOMMENDED ACTION 3:

Many older homes in the area may be at risk for fire damage due to insufficient tree and propane tank setback distances. Fire hydrants may be located too far away from homes, especially in rural areas, reducing their effectiveness. In addition, many current residences have narrow driveways that are very difficult for emergency vehicles to access.

It is recommended to develop and adopt development design standards based upon FIREWISE principles and defensible space into the County's subdivision ordinance. The design standards should include standard setbacks from trees and above-ground propane tanks, dry hydrants, and minimum distances from fire hydrants. FIREWISE recommended building materials should also be specified.

Responsible Party:	Planning and Zoning; Virginia Department of Forestry; Fire, Rescue, and Emergency Management
Priority (H,M,L):	Medium
Cost Estimate	Costs will include staff time for the development of the standards to incorporate into the Subdivision ordinance and proper public hearing and notice prior to action by the County Board of Supervisors.
Community Benefit:	Incorporation of the FIREWISE principles in new and re-development projects throughout the County will, over time, decrease the likelihood of insured fire damage from wildfire.
Potential Funding:	Existing Budget
Schedule:	Within 2 years

RECOMMENDED ACTION 4:

During hurricanes, severe thunderstorms, and winter storm events, debris often falls on power lines causing widespread and long-term power outages. Power outages result in disgruntled citizens and traffic management issues.

It is recommended to create a multi-season power line right-of-way maintenance plan in conjunction with Virginia Dominion Power and Rappahannock Electric Cooperative

Responsible Party:	Planning; Fire, Rescue, and Emergency Management; Virginia Dominion Power; Rappahannock Electric Cooperative
Priority (H,M,L):	Medium
Cost Estimate:	Staff Time
Community Benefit:	Maintain power during severe weather events; traffic safety
Potential Funding:	Existing Budget
Schedule:	Within 4 years

RECOMMENDED ACTION 5:

The County noted power generation as a key component of providing services during and after a disaster. Other critical infrastructure to be considered includes water and sewer system operability, transportation infrastructure integrity, and the integrity of other municipal facilities, such as the County's Emergency Operations Center (EOC).

It is recommended to identify priorities for protection among critical facilities identified in this plan as well as methods for protection against natural hazards, including the retrofitting of structures for quick external power generator hook up.

Responsible Party:	Fire, Rescue, and Emergency Management; County Utilities; Sheriff
Priority (H,M,L):	Medium/High
Cost Estimate:	Cost estimates will vary based on the measures identified and the specific facilities' respective conditions and locations.
Community Benefit:	Continued viability of critical infrastructure before, during, and after a disaster can decrease potential losses or property damage that would only be exacerbated by loss of these critical functions.
Potential Funding:	Grant funding for the protection of wastewater facilities is available from the Environmental Protection Agency. Retrofitting of facilities for quick external power generator hook up has been classified as an acceptable mitigation activity for the HMGP and PDM grant programs.
Schedule:	Within 2 years

GOAL #2: Educate and engage the public regarding hazards, their impacts, and feasible actions.

Objective 2.1: Develop a seasonal multi-hazard public education program to be implemented annually.
Objective 2.2: Encourage citizens to observe and report potential hazard events

RECOMMENDED ACTION 6:

It is recommended to develop a Regional Public Awareness Program.

See Regional Recommended Action 2.

RECOMMENDED ACTION 7:

An option for public involvement includes the NOAA weather spotting program. Weather Spotters provide invaluable assistance and critical information to decision makers when hazardous weather threatens the community. Countless lives have been saved because of this unique partnership among volunteer storm spotters, emergency management officials and the National Weather Service.

It is recommended to develop a Weather Spotter program within the County.

Responsible Party:	Emergency Management; NOAA Weather Spotter Trainer
Priority (H,M,L):	Medium
Cost Estimate:	Training Facility Cost and Staff Time
Community Benefit:	Public Safety, increased awareness and warning times
Potential Funding:	Existing Budget; Grant Funding
Schedule:	Within 2 years

GOAL #3: Maximize the impact of public resources through effective coordination and the efficient use of technology.

Objective 3.1: Establish regional GIS coordination.
Objective 3.2: Establish a minimum standard for GIS capabilities and data.

RECOMMENDED ACTION 8:

It is recommended to establish a minimum standard for GIS capabilities and data throughout the RADCO region as jurisdictions begin to add GIS to their current hazard mitigation capabilities.

See Regional Recommended Action 3.

RECOMMENDED ACTION 9:

It is recommended to establish a clearinghouse of GIS data for all RADCO jurisdictions. This will allow all jurisdictions to have access to compatible data in order to better assess the region and each community's vulnerability to the natural hazards identified in this plan.

See Regional Recommended Action 4.

GOAL #4: Improve and enhance emergency management capabilities.

Objective 4.1: Improve Regional Level of Warning System Capabilities.
Objective 4.2: Improve Regional Coordination.

RECOMMENDED ACTION 10:

It is recommended to establish an early warning system for jurisdictions in the RADCO region that can provide event-distinct information to citizens and businesses.

See Regional Recommended Action 5.

RECOMMENDED ACTION 11:

It is recommended to improve the flexibility of the transportation network through coordination with the Virginia Department of Transportation (VDOT) and neighboring regions.

See Regional Recommended Action 6.

RECOMMENDED ACTION 12:

It is recommended to investigate the feasibility of establishing a common means of communication, such as one radio frequency or equipment to connect existing radio frequencies, for use by all emergency services departments in the RADCO region.

See Regional Recommended Action 7.

RECOMMENDED ACTION 13:

It is recommended to investigate and potentially purchase the equipment required to eliminate radio communication gaps in valleys.

See Regional Recommended Action 8.

7.2.5 Stafford County Recommended Action Items

GOAL #1: Reduce the future impacts and losses from identified hazards.

Objective 1.1: Develop a coordinated set of mitigation actions that address the following specific hazards:
a. Flooding;
b. Wildfires; and
c. Severe Weather (tornadoes, winter storms, northeasters, and hurricanes).
Objective 1.2: Protect critical facilities.

RECOMMENDED ACTION 1:

The County has approximately 1,900 parcels affected by the currently mapped floodplain. In addition, the County has 8 properties that appear on FEMA's repetitive loss list for having filed two flood insurance claims of $1,000 or more in a ten-year period. Mitigation of repetitive flood losses is FEMA's top mitigation priority. If the County's repetitive loss property owners are interested in an approved mitigation measure (i.e. relocation of the structure, elevation in place, buy-out, flood proofing [if a non-residential structure]), funding for such activity can come from a variety of sources. Projects may have to pass a benefit-cost analysis.

Additionally, the County has several historical homes that repeatedly flood. Potential retrofitting measures are available within the NFIP regulations.

It is recommended to investigate the feasibility of mitigating the County's repetitive loss structures and historic homes from future flooding events.

Responsible Party:	Planning, Emergency Management; Historic Preservation Planner
Priority (H,M,L):	High
Cost Estimate	Cost will depend on the mitigation method chosen.
Community Benefit:	Public education, elevating, removing, or otherwise mitigating a structure greatly reduces the chances for future damage from flooding. Mitigation of repetitive loss structures is FEMA's top priority for mitigation funding.
Potential Funding:	Potential funding sources include the HMGP and PDM programs. Potential matching fund sources include the property owners themselves and the County, potentially in conjunction with the Commonwealth.
Schedule:	Within 2 years

RECOMMENDED ACTION 2:

Stafford County recognizes that while new development in the floodplain is not a widespread concern, pre-existing structures, and especially mobile homes, exist in the community's floodplain and are subject to potential damage from flooding. Proper anchoring can prevent existing mobile homes from floating during a flood, which can prevent more widespread flooding damage related to a floating structure blocking a bridge or major drainage way. Retrofitting/raising existing structures can prevent flooding of existing structures.

It is recommended to ensure proper elevation through retrofit and anchoring of mobile homes and other attendant appurtenances located in the floodplain to reduce the risk of future flood damage.

Responsible Party:	County Building Inspector; Floodplain Manager
Priority (H,M,L):	High
Cost Estimate	Capital cost of anchor/foundation
Community Benefit:	Prevent repetitive losses
Potential Funding:	Existing Budget; PDM and HMGP Funding
Schedule:	Within 5 years

RECOMMENDED ACTION 3:

Storm water retention/detention facilities located within the community, specifically Home Owners' Associations, often malfunction and fail. Additionally, maintenance programs are often limited or non-existent.

It is recommended to increase the inspection cycle for public and private storm water detention/retention facilities.

Responsible Party:	Public Services Engineer; NPDES Coordinator
Priority (H,M,L):	Low/Medium
Cost Estimate	Addition of new employee, inspector
Community Benefit:	Life-Safety; Property Protection; Pro-active approach to flood mitigation; FEMA eligibility
Potential Funding:	Existing Budget
Schedule:	Within 3 years

RECOMMENDED ACTION 4:

Many older homes in the area may be at risk for fire damage due to insufficient tree and propane tank setback distances. Fire hydrants may be located too far away from homes, especially in rural areas, reducing their effectiveness. In addition, many current residences have narrow driveways that are very difficult for emergency vehicles to access.

It is recommended to develop and adopt development design standards based upon FIREWISE principles and defensible space into the County's subdivision ordinance. The design standards should include standard setbacks from trees and above-ground propane tanks, dry hydrants, and minimum distances from fire hydrants. FIREWISE recommended building materials should also be specified.

Responsible Party:	Planning and Zoning, Virginia Department of Forestry; Fire Marshall
Priority (H,M,L):	Medium
Cost Estimate	Costs will include staff time for the development of the standards to incorporate into the Subdivision ordinance and proper public hearing and notice prior to action by the County Board of Supervisors
Community Benefit:	Incorporation of the FIREWISE principles in new and re-development projects throughout the County will, over time, decrease the likelihood of fire damage from wildfire.
Potential Funding:	Existing Budget
Schedule:	Within 1 year

RECOMMENDED ACTION 5:

Severe weather has been identified by the HMPC as critical hazard for the Stafford County. Potential mitigation measures for severe weather may include hurricane clips, safe rooms, model shelters, and warning systems. Safe rooms are reinforced small rooms built in the interior of a home, which are fortified by concrete and/or steel to offer extra protection against tornadoes, hurricanes and other severe windstorms. Shelters are excellent ideas for apartment complexes, schools, mobile home parks, factories, office complexes and other facilities where large groups of people live, work or study.

It is recommended to investigate safeguards against severe weather including hurricane clips, safe rooms, community shelters, and/or model shelters.

Responsible Party:	Emergency Management
Priority (H,M,L):	Medium
Cost Estimate:	Staff Time
Community Benefit:	Reduced losses, Life-Safety, public education for residents within the community
Potential Funding:	Existing Budget
Schedule:	Within 3 years

RECOMMENDED ACTION 6:

Proactive tree-trimming efforts reduce the risk of losing power due to downed trees and branches during severe storms, thereby increasing the safety of the local residents. Additionally, the cost for early trimming can be significantly less than the cost to rebuild or repair power grids.

It is recommended to investigate the development of a tree-trimming program, which includes training for local contractors.

Responsible Party:	Emergency Management w/ VDOF and Utilities
Priority (H,M,L):	Medium
Cost Estimate:	Staff Time
Community Benefit:	Life-Safety; Debris Management
Potential Funding:	Existing Budget
Schedule:	Within 3 years

RECOMMENDED ACTION 7:

Critical facilities are the community's assets that are the most important or vital to emergency management functions. Critical facilities warrant special attention in preparing for a disaster and are of vital importance to maintaining citizen life, health, and safety during and/or directly after a disaster event. Identifying these facilities using the community's GIS capabilities will allow for spatial analysis with hazard areas and improved community planning.

It is recommended to identify all critical facilities using GIS.

Responsible Party:	GIS/IT Departments; County Facilities: Emergency Management
Priority (H,M,L):	Medium
Cost Estimate:	Staff Time
Community Benefit:	Critical Facility Protection
Potential Funding:	Existing Budget
Schedule:	Within 1 year

RECOMMENDED ACTION 8:

The County noted power generation as a key component of providing services during and after a disaster. Other critical infrastructure to be considered includes water and sewer system operability, transportation infrastructure integrity, and the integrity of other municipal facilities, such as the County's Emergency Operations Center (EOC).

It is recommended to identify priorities for protection among critical facilities identified in this plan as well as methods for protection against natural hazards, including the retrofitting of structures for quick external power generator hook up.

Responsible Party:	Emergency Management
Priority (H,M,L):	Medium/High
Cost Estimate:	Cost estimates will vary based on the measures identified and the specific facilities' respective conditions and locations.
Community Benefit:	Continued viability of critical infrastructure before, during, and after a disaster can decrease potential losses or property damage that would only be exacerbated by loss of these critical functions.
Potential Funding:	Grant funding for the protection of wastewater facilities is available from the Environmental Protection Agency. Retrofitting of facilities for quick external power generator hook up has been classified as an acceptable mitigation activity for the HMGP and PDM grant programs.
Schedule:	Within 2 years

GOAL #2: Educate and engage the public regarding hazards, their impacts, and feasible actions.

Objective 2.1: Develop a seasonal multi-hazard public education program to be implemented annually.
Objective 2.2: Encourage citizens to observe and report potential hazard events

RECOMMENDED ACTION 9:

It is recommended to develop a Regional Public Awareness Program.

See Regional Recommended Action 2.

GOAL #3: Maximize the impact of public resources through effective coordination and the efficient use of technology.

Objective 3.1: Establish regional GIS coordination.
Objective 3.2: Establish a minimum standard for GIS capabilities and data.

RECOMMENDED ACTION 10:

It is recommended to establish a minimum standard for GIS capabilities and data throughout the RADCO region as jurisdictions begin to add GIS to their current hazard mitigation capabilities.

See Regional Recommended Action 3.

RECOMMENDED ACTION 11:

It is recommended to establish a clearinghouse of GIS data for all RADCO jurisdictions. This will allow all jurisdictions to have access to compatible data in order to better assess the region and each community's vulnerability to the natural hazards identified in this plan.

See Regional Recommended Action 4.

GOAL #4: Improve and enhance emergency management capabilities.

Objective 4.1: Improve Regional Level of Warning System Capabilities.
Objective 4.2: Improve Regional Coordination.

RECOMMENDED ACTION 12:

It is recommended to establish an early warning system for jurisdictions in the RADCO region that can provide event-distinct information to citizens and businesses.

See Regional Recommended Action 5.

RECOMMENDED ACTION 13:

It is recommended to improve the flexibility of the transportation network through coordination with the Virginia Department of Transportation (VDOT) and neighboring regions.

See Regional Recommended Action 6.

RECOMMENDED ACTION 14:

It is recommended to investigate the feasibility of establishing a common means of communication, such as one radio frequency or equipment to connect existing radio frequencies, for use by all emergency services departments in the RADCO region.

See Regional Recommended Action 7.

RECOMMENDED ACTION 15:

It is recommended to investigate and potentially purchase the equipment required to eliminate radio communication gaps in valleys.

See Regional Recommended Action 8.

7.3 Other Action Items Considered

Not all of the mitigation actions presented to and/or discussed by the HMPC became recommended action items. Action items may not have been considered to be cost-effective or support the community's goals. Additionally, action items may have lacked political support, constituent support, and funding. Action items not recommended or included in the priority list are presented below.

- Investigate engineering solutions for roadway flooding issues (jurisdiction by jurisdiction).
- Tank management.
- Identify appropriate slope criteria and determination methods to evaluate potential for slope-related hazards. Start on a pilot basis.
- Low to no interest loans as incentives for property owners that have no viable alternatives to residing in the floodplain.
- Develop local ordinances prohibiting new development in the floodplain.
- Establish a special tax district that would provide an added tax for residents in the floodplain based on the increased cost of responding to flood emergencies in the floodplain.
- Purchase development rights in the floodplain.
- Develop sub-basin master plans for water quantity to establish baselines of service from local engineering and public works agencies.
- Educate the local insurance industry on the potential benefits of CRS program participation.
- Revise local zoning ordinances to encourage low-density development in hazard areas post-disaster.
- Extend GIS data gathering beyond the RADCO boundaries; hazards may cross political boundaries.

8.0 Plan Implementation and Maintenance

Implementation implies two concepts: action and priority. While this plan puts forth many worthwhile recommendations, the decision regarding which action to undertake first will be the initial issue each community faces. HMPC members should not only account for priority when considering which task should be addressed first, they should also consider the issue of funding. Therefore, low or no-cost recommendations have the greatest likelihood of succeeding. An example would be updating the floodplain management ordinance to require 110 percent compensatory storage. These efforts would lead to long-standing reductions in vulnerability and can be initiated at very little cost.

Another important implementation mechanism that is highly effective but low-cost is taking steps to incorporate the recommendations, and equally important, the underlying principles of this Hazard Mitigation Plan into other community plans such as Comprehensive Plans, capital improvement budgeting, economic development goals and incentives, and other such plans. Mitigation is most successful when it is incorporated within the day-to-day functions and priorities of government and development. This integration is accomplished by a constant, pervasive, and energetic effort to network and to identify and highlight the multi-objective, "win-win" benefits to each program, the communities, and their constituents. This effort is achieved through monitoring agendas, attending meetings, sending memos, and promoting a safe, sustainable community.

Monitoring funding opportunities should be done simultaneously with the integration effort. Funding can be leveraged to implement some of the more costly recommendations. A bank of ideas should be created and maintained to track how any required local match or participation requirements can be met. Being aware of when funding becomes available will allow the HMPC to capitalize upon important opportunities. Funding opportunities that can be monitored include special pre- and post-disaster funds, special district budgeted funds, state or federal ear-marked funds, and grant programs, including those that can serve or support multi-objective applications.

With the adoption of this plan, the HMPC will be converted to a permanent advisory body. This HMPC agrees and commits to:

- Act as a forum for hazard mitigation issues.
- Disseminate hazard mitigation ideas and activities to all participants.
- Pursue the implementation of the high priority, low/no-cost Recommended Actions.
- Keep the concept of Mitigation in the forefront of communities' decision-making by identifying the recommendations of this plan when other community goals, plans, and activities overlap, influence, or directly affect increased community vulnerability to disasters.
- Maintain a vigilant monitoring of multi-objective cost-share opportunities to assist the communities' in implementing the Recommended Actions of this plan for which no current funding or support exists.
- Monitor implementation of this Plan.
- Report on progress and recommended changes to the appropriate City Manager/County Administrator's Office.
- Inform and solicit input from the public.

The HMPC will not have any powers over City/County staff; it will serve only as an advisory body. Its primary duty is to see the Plan successfully carried out and to report to the City Manager/County Administrator's Office and the public on the status of Plan implementation and mitigation opportunities in the RADCO communities. Other duties include reviewing and promoting mitigation proposals, hearing stakeholder concerns about hazard mitigation, passing the concerns on to the appropriate entities, and posting relevant information on the communities' websites.

8.1 Maintenance

Plan maintenance implies an ongoing effort to monitor and evaluate the implementation of the plan, and to update the plan as progress, roadblocks, or changing circumstances are recognized. This monitoring and updating will take place through an annual review by the HMPC and a five-year written update to be submitted to the state and FEMA Region III, unless disaster or other circumstances (e.g. changing regulations) lead to a different timeframe.

When the HMPC convenes for the review, they will coordinate with all stakeholders that either participated in the original planning process, or have joined the HMPC since the inception of the planning process. The goal will be to update and revise the plan. Public notice will be given and public participation will be encouraged. The invitation to participate will be extended via web-postings and press releases to the local media outlets.

The evaluation of progress can be achieved by monitoring changes in the vulnerability identified in the Plan. Changes in vulnerability can be identified by noting:

- Lessened vulnerability as a result of implementing Recommended Actions;
- Increased vulnerability as a result of failed or ineffective mitigation actions; and/or,
- Increased vulnerability because of new development.

The updating of the Plan will be accomplished through written changes and submissions as the HMPC deems necessary, and as approved by the governing bodies of each community.

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Glossary of Terms	
Term	**Definition**
Acquisition of Hazard-Prone Structures	Local governments can acquire lands in high hazard areas through conservation easements, purchase of development rights, or outright purchase of property.
Base Flood Elevation (BFE)	The elevation of the Base Flood in relation to a specified datum, such as the National Geodetic Vertical Datum of 1929. The Base Flood Elevation is used as a standard for the National Flood Insurance Program (NFIP). The Base Flood is the flood that has a 1% chance of being equaled or exceeded in any given year. The Base Flood is also referred to as the 100-Year Flood.
BCEGS	Building Code Effectiveness Grading Scale
Capability Assessment	An assessment that provides a description and analysis of a community or state's current capacity to address the threats associated with hazards. The capability assessment attempts to identify and evaluate existing policies, regulations, programs, and practices that positively or negatively affect the community or state's ability to address specific hazards or threats.
CoBRA	Coastal Barrier Resources Act in 1982. The CoBRA, while not prohibiting privately financed development, prohibits most new Federal financial assistance, including flood insurance, within an area designated as part of the Coastal Barrier Resources System (CBRS).
Community Rating System (CRS)	An incentive-based program for NFIP participating communities that implement flood mitigation programming above the NFIP minimum measures that reduce flood hazard risk. In return for enhanced flood mitigation programming, policy holders in participating communities enjoy discounted flood insurance premiums.
Cost-Effectiveness	One evaluation criteria for federal grant programs. FEMA defines a cost-effective project as one whose long-term benefits exceed its costs. That is, a project should prevent more expected financial loss than it costs initially to fund the effort. Benefit-cost analysis is one way to illustrate that a project is cost-effective.
Critical Facilities	Facilities vital to the health, safety, and welfare of the population and that are especially important following hazard events. Critical facilities include, but are not limited to, shelters, police and fire stations, utility facilities, and hospitals.
Disaster Mitigation Act of 2000 (DMA 2000)	DMA 2000 (Public Law 106-390) is the latest legislation to improve the planning process. Signed into law on October 30, 2000, this legislation reinforces the importance of mitigation planning and emphasizes planning for disasters before they occur.
Elevation of Structures	Term used in conjunction with floodplain management. Raising structures above the base flood elevation to protect structures located in areas prone to flooding.
Erosion	Wearing away of the land surface by detachment and movement of soil and rock fragments, during a flood or storm or over a period of years, through the action of wind, water, or other geologic processes.
Federal Emergency Management Agency (FEMA)	Agency created in 1979 to provide a single point of accountability for all federal activities related to disaster mitigation and emergency preparedness, response, and recovery. FEMA is now part of the Department of Homeland Security.
Flood	A general and temporary condition of partial or complete inundation of normally dry land areas from (1) the overflow if inland or tidal waters, (2) the unusual and rapid accumulation or runoff of surface waters from any source, or (3) mudflows or the sudden collapse of shoreline land.
Flood Elevation	Elevation of the water surface above an established datum, e.g. National Geodetic Vertical Datum of 1929, North American Vertical Datum of 1988 or Mean Sea Level.
Flood Insurance Rate Map (FIRM)	Map prepared by the Federal Emergency Management Agency showing both the Special Flood Hazard Area (SFHA) and the risk premium zones applicable in a given community.
Flood Mitigation Assistance (FMA) Program	A program created as part of the National Flood Insurance Reform Act of 1994. FMA provides funding to assist communities and states in implementing actions that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other NFIP insurable structures, with a focus on repetitive loss properties.
Floodplain	Any land area, including watercourse, susceptible to partial or complete inundation by water from any source.
Floodproofing	Actions that prevent or minimize future flood damage. Making the areas below the anticipated flood level watertight (dry flood proofing) or intentionally allowing floodwaters to enter the interior to equalize flood pressures are examples of flood proofing (wet flood proofing).
Flood Zone	A geographical area shown on a Flood Insurance Rate Map (FIRM) that reflects the severity or type of flooding in the area.
Frequency	A measure of how often events of a particular magnitude are expected to occur. Frequency describes how often a hazard of a specific magnitude, duration, and /or extent typically occurs, on average. Statistically, a hazard with a 100-year recurrence interval is expected to occur once every 100 years on average, and would have a 1% chance of happening in any given year.
Geographic Information System (GIS)	A computer software application that relates physical features on the earth to a database to be used for mapping and analysis.
Goals	General guidelines that express desired results. They are usually broad policy-type statements, long term in nature, and represent global visions.

Glossary of Terms	
Term	**Definition**
Hazard	A source of potential danger or adverse condition. Hazards include naturally occurring events such as floods, earthquakes, tornadoes, tsunamis, coastal storms, landslides, and wildfires that strike populated areas and have the potential to harm people property.
Hazard Mitigation	Sustained actions taken to reduce or eliminate long-term risk from hazards and their effects.
Hazard Mitigation Grant Program (HMGP)	Authorized under Section 404 of the Roger T. Stafford Disaster Relief and Emergency Assistance Act, HMGP is administered by implementing hazard mitigation actions after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to disasters and to enable mitigation activities to be implemented as a community recovers from a disaster.
Hazard Profile	A description of the physical characteristics of hazards and a determination of various descriptors including magnitude, duration, frequency, probability, and extent.
Hurricane	An intense tropical cyclone, formed in the atmosphere over warm ocean seas, in which wind speeds reach 74 miles-per-hour or more and blow in a large spiral around a relatively calm center or "eye". Hurricane circulation is counter-clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.
Hydrology	The study of water's overland flow characteristics. A flood discharge is developed by a hydrologic study.
Infrastructure	Infrastructure includes communication technology such as phone lines or internet access, vital services such as public water supplies and sewer treatment facilities, and transportation systems such as airports, highways, bridges, tunnels, roadbeds, overpasses, railways, bridges, rail yards, depots, waterways, and canals.
Lowest Floor	Under the NFIP, the lowest floor of the lowest enclosed area (including basement) of a structure.
Magnitude	Measures the strength of a hazard event. The magnitude (also referred to as severity) of a given hazard event is usually determined using technical measures specific to the hazard.
Mitigation Plan	The document that articulates results from the systematic process of identifying hazards and evaluating vulnerability, identifying goals, objectives, and actions to reduce or eliminate the effects of identified hazards, and an implementation plan for carrying out the actions.
National Flood Insurance Program (NFIP)	A Federal program created by Congress in 1968 that provides federally backed flood insurance in communities that enact minimum floodplain management regulations in 44 CFR 60.3.
National Weather Service (NWS)	Prepares and issues flood, severe weather, and coastal storm warnings and can provide technical assistance to Federal and state entities in preparing weather and flood warning plans.
Nor'easter	An extra-tropical cyclone producing gale-force winds and precipitation in the form of heavy snow or rain.
Objectives	Objectives define strategies or implementation steps to attain identified goals. Unlike goals, objectives are specific and measurable.
Open Space Preservation	Preserving undeveloped areas from development through any number of methods, including low-density zoning, open space zoning, easements, or public or private acquisition. Open space preservation is a technique that can be used to prevent flood damage in flood-prone soils, and can enhance the natural and beneficial functions of floodplains.
Post-Disaster Recovery Planning	The process of planning those steps the jurisdiction will take to implement long-term reconstruction with a primary goal of mitigating its exposure to future hazards. The post-disaster recovery planning process can also involve coordination with other types of plans and agencies, but it is distinct from planning for emergency operations.
Probability	In terms of natural hazards, the likelihood a hazard event will occur in a given time period.
Repetitive Loss Property	A property that is currently insured that has two or more NFIP losses (occurring more than ten days apart) of at least $1,000 each and have been paid within any 10-year period since 1978.
Replacement Value	The cost of rebuilding a structure. This is usually expressed terms of cost per square foot, and reflects the present-day cost of labor and materials to construct a building of a particular size, type and quality. This is not the same as market value.
Risk	The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as high, moderate or low likelihood of sustaining damage above a particular threshold due to a specific type of hazard event. It also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.
Special Flood Hazard Area (SFHA)	An area within a floodplain having a 1 % or greater chance of flood occurrence in any given year (100-year floodplain); represented on Flood Insurance Rate Maps by darkly shaded areas with zone designations that include the letter A or V.
Stakeholders	Individuals or groups, including businesses, private organizations, and citizens that will be affected in any way by an action or policy.
State Hazard Mitigation Officer (SHMO)	The representative of state government who is the primary point of contact with FEMA, other state and Federal agencies, and local units of government in the planning and implementation of pre- and post disaster mitigation activities.
STAPLE/E	This methodology requires that the social, technical, administrative, political, legal, economic, and environmental considerations be taken into account when reviewing potential actions for the community to undertake.

Glossary of Terms	
Term	**Definition**
Storm Surge	Rise in the water surface above normal water levels on the open coast.
Sub-Tropical Depression	A weather system that has some characteristics of a tropical cyclone and some characteristics of an extratropical cyclone.
Subdivisions and Development Regulations	Regulations and standards governing the division of land for development for sale. Subdivision regulations can control the configuration of parcels, set standards for developer-built infrastructure, and set standards for minimizing runoff, impervious surfaces, and sedimentation during development. They can be used to minimize exposure of buildings and infrastructure to hazards.
Tornado	A violently rotating column of air extending from a thunderstorm to the ground.
Tropical Cyclone	A generic term for a cyclonic, low-pressure system over tropical or subtropical waters.
Tropical Depression	A tropical cyclone with maximum sustained winds of less than 39 mph.
Tropical Storm	A tropical cyclone with maximum sustained winds greater than 39 mph and less than 74 mph.
Vulnerability Assessment	The study of the extent of injury and damage that may result from a hazard event of a given magnitude in a given area. Vulnerability assessments typically address impacts of hazard events on the existing and future built environment.
Zoning Ordinances	Designation of allowable land use and intensities for a local jurisdiction. Zoning ordinances consist of two components: a zoning text and a zoning map.

Appendix A

HMPC Meetings Agendas and Minutes

HMPC Correspondence

HAZARD MITIGATION PLANNING COMMITTEE

The Hazard Mitigation Planning Committee met nine times during the planning process. Meeting dates were scheduled as follows:

- October 5th - Kickoff Meeting;
- October 26th - Hazard Identification and Risk Assessment (HIRA) Introduction;
- November 30th – HIRA First Draft;
- January 13th - Assessment and Goal Setting;
- March 17th - Review Possible Mitigation Activities;
- April 15th - Review Possible Mitigation Activities;
- May 19th – Draft Plan;
- September 15th – Draft Plan; and
- December 15th – Discussion of public comments and final review of Draft Plan.

HAZARD MITIGATION PLANNING COMMITTEE

MEETING #1

11:00 AM, October 5, 2004

Meeting Agenda

1. Welcome
2. Introductions
3. The Roles of the Coordinating and Planning Committees
4. Mitigation, Mitigation Planning, & the Disaster Mitigation Act Requirements
5. AMEC Project Approach and Schedule
6. Data Needs
   - 6.1. Report of initial data gathering
   - 6.2. HAZUS overview
   - 6.3. Available data in the communities
7. Coordinating with Other Agencies
8. Planning for Public Input
9. Questions
10. Adjourn

HAZARD MITIGATION PLANNING COMMITTEE

MEETING #1

11:00 AM, October 5, 2004

Meeting Minutes

In Attendance:

Hazard Mitigation Planning Committee Members:

Mark Bledsoe	City of Fredericksburg - Fire
Wendy Shepherd	King George County
Eddie Allen	City of Fredericksburg - Fire
Bruce Sterling	VDEM
Kathy Beck	Fredericksburg Transit
Edward Fuzzy	Caroline County Fire and Rescue
Matt Stafford	Caroline County Planning Department
Dan Curran	Town of Bowling Green
Philip K. Brown	City of Fredericksburg - Graphics
Stephen Manster	RADCO
Kerry Maloney	Spotsylvania County
Mary Durrance	Stafford County Planning
Chuck Thompson	Stafford County Fire and Rescue
Jack Green	King George County
Kyle Conboy	King George County
Patricia Quann	RADCO
Beth Payne	RADCO
Steve Hubble	Stafford County

Consultants:

Doug Moseley Celia Prentice Kristen Kilby Chris Stone

Agenda and Discussion:

Mr. Moseley welcomed the RADCO committee members and introduced the hazard mitigation consulting team from AMEC Earth & Environmental Inc. (AMEC). Doug Moseley is AMEC's subject matter expert and will serve as the project manager (and the initial point of contact) for this project. Celia Prentice will be the second POC for the project. Kristen Kilby will serve as the Senior Planner. Chris Stone will serve as the HAZUS point of contact/coordinator. Mr. Moseley, Ms. Prentice, Ms. Kilby and Mr. Stone all work in AMEC's Chantilly, VA office and will be doing the majority of work for this project.

The consulting team opened the meeting by asking the committee members to share some of their hazard mitigation roles and responsibilities and to assist the consulting team in understanding individual backgrounds and to become more familiar with the resources the committee members bring to the planning process.

After the initial discussion, Mr. Moseley gave a presentation on who, what, when, where, why and how the Multi-Hazard Mitigation Plan applies to the Rappahannock Area Development Commission's jurisdictions. Among other topics, he noted the importance of the committee working together with AMEC for this plan to be a success. The committee then discussed other potential entities that may wish to participate in this planning effort. Suggestions for other local agencies/entities that may wish to participate included:

- Waste management agencies,
- The health department (regional health),
- The Red Cross/blood bank,
- Local agricultural extension offices,
- IT staff,
- Representatives from Dahlgren, Quantico, Fort AP Hill, and North Anna Power Station.

AMEC will draft a letter for RADCO to distribute to these and other sources inviting their participation in the planning process. In addition to these local entities, the committee also noted a need to communicate with the Virginia Health Department, Virginia DEQ (regional offices Woodbridge/Richmond), the National Weather Service (Sterling and Wakefield offices), Department of Conservation and Recreation (DCR) (Richmond), US Army Corps of Engineers, and the region's Extension offices. Mr. Moseley stressed the importance of keeping an open line of communication with outside agencies during the planning process.

To introduce the rationale for mitigation planning, Mr. Moseley noted that FEMA is now promoting pre-disaster mitigation initiatives and policies, as pre-disaster mitigation appears to be more cost beneficial than waiting for a disaster to strike before acting. The cost benefit in these cases is "what disasters are not going to happen in the future" ("future losses avoided"). Many natural hazard events are predictable and repetitive, loss reduction activities can be undertaken to mitigate damage. Mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to human life and property from hazards. Mr. Moseley addressed the Disaster Mitigation Act of 2000 (DMA 2K) local planning criteria, including:

- A ***risk assessment***: A description of all hazards (human-caused/natural) that can affect the jurisdiction, including past occurrences and probable future hazard events.
- A ***vulnerability assessment*** that includes types and number of buildings, infrastructure and critical facilities (fire, police, hospitals) at risk per hazard, an estimate of potential financial losses and a general description of land-uses and development trends.
- A ***mitigation strategy*** that includes local goals and objectives, and proposed strategies, programs and actions to reduce vulnerability and an action plan, describing how the proposed actions will be prioritized, implemented, and administered.
- A ***plan maintenance*** process that includes a method and schedule of monitoring, evaluation and updating the plan within a 5-year cycle and a process to incorporate the plan into other mechanisms, i.e. comprehensive or capital improvement plans.

All these requirements can be broken down into the 10-step planning process that is consistent with the planning processes established for other federal programming, including the Flood Mitigation Assistance program and the Community Rating System. The breakdown is as follows:

1. Get organized
2. Plan for public involvement
3. Coordinate with other departments and agencies
4. Identify the hazards
5. Assess the risks
6. Set planning goals
7. Review possible activities
8. Draft an action plan
9. Adopt the plan
10. Implement the plan, evaluate its worth, and revise as needed

Mr. Moseley then led a brief discussion on AMEC's scope of work and schedule for plan completion and adoption. The schedule has been designed to get RADCO's plan approved by FEMA Region III and the Commonwealth of Virginia by June 1, 2005, thus making the area formally eligible for FY2005 Pre-Disaster Mitigation (PDM) funding. PDM funding comes from a nationwide pot of money, while Hazard Mitigation Grant Program (HMGP) funding is triggered by a presidentially declared disaster. Mr. Stone was discussed the benefits of the planning tool HAZUS. He discussed the value of the software and how it would benefit the RADCO area. Ms. Prentice discussed the human caused section of this plan and asked the Committee to provide any additional locations in the RADCO area that may warrant consideration. The committee then shared some specific locations and concerns, including additional power generation facilities, petroleum facilities, and other infrastructure.

Mr. Moseley shared contact information for the AMEC team with the committee and discussed with the committee the best date for the next committee meeting. It was determined that it would be on October 26, 2004. The purpose for the next meeting is to examine the hazard identification and risk assessment materials gathered by the consulting team. The third meeting is currently scheduled for November 16th and will be held from 11-1pm.

Rappahannock Area Development Commission
Multi-Hazards Mitigation Planning Project

PRESS RELEASE #1

The Rappahannock Area Development Commission (RADCO), along with its member jurisdictions, is participating in a planning effort to increase the region's readiness in the event of a natural or man-made disaster and maintain the region's eligibility for disaster mitigation funding available from FEMA, the Federal Emergency Management Agency. FEMA is the federal agency that assists state and local governments in recovering from disasters. Mitigation funding is provided to reduce the impacts of future disasters resulting from natural hazards, such as floods, tornadoes, and ice storms. The Disaster Mitigation Act (DMA) established the requirement in October of 2000. RADCO has also chosen to address man-made hazards in the region's plan.

Following September 11, 2001, FEMA became part of the Department of Homeland Security, and additional requirements were established for communities to prepare for and respond to terrorist threats, and those planning efforts are already underway. This plan, however, is only required to address the reduction of losses from natural disasters, including droughts, blizzards and even unusual natural disasters, such as outbreaks of West Nile Virus, and possible future disasters, such as the impact of a hurricane. Guidance states that, where possible and sensible, the plans for natural and man-made disasters should be coordinated. RADCO is facilitating this coordination.

Each incorporated municipality within the region must participate in the planning process in order to maintain their own eligibility since each could be individually affected by a disaster. However, because the same hazards threaten many of the communities similarly, the planning can be done together.

The planning process is already underway, and will continue through the spring of 2005. You are invited to submit your comments and ideas, and attend the planning meetings. RADCO's point-of-contact is Steven Manster, RADCO's executive director, who can be reached at (540) 373-2890, in writing at 3304 Bourbon Street, Fredericksburg, VA, 22408, or email at smanster@fampo.state.va.us . The planning progress will also be posted on the RADCO website at www.radco.state.va.us.

Currently, the planning committee is identifying and quantifying the hazards that can affect the region and then information will be collected on past disasters and future potential losses. Following these initial efforts, the next step will be to identify what systems the communities within the region already have in place to lessen the impact of such disasters, such as an Emergency Management office, warning systems, floodplain regulations, land-use designations, levees, dams and building codes. Once this assessment of capabilities has been completed, the next step is to determine if the communities need to strengthen existing systems or implement new systems. These needs will become the goals of the plan.

Your input to the planning process is valuable and is welcome at any point, now or in the future. If you have suffered any disaster related losses, or have a localized problem that may cause or aggravate losses in the future --- such as a drainage, erosion, or soils problem --- please contact Patricia Quann at (540) 373-2890.

In the coming months we will announce formal public meetings that the Planning Team will be conducting in different locations where you can comment on both the Risk Assessment portion of the Plan, as well as the Draft Plan before it is officially adopted and submitted to FEMA. Your comments, and how the Planning Team addresses them, will be recorded and included in the final plan.

HAZARD MITIGATION PLANNING COMMITTEE

MEETING #2

11:00 AM, October 26, 2004

Meeting Agenda

1. Welcome and Introductions

2. Review of the Planning Process

3. Review of Disaster Mitigation Act Requirements

4. Discussion of Hazard Identification

4.1. Natural Hazards
4.2. Human-Caused Hazards

5. Assessing the Risks

6. Goal Development Process

7. Data Collection

7.1. Data Collection Needs (What We Need Now)
- a) *Refine Hazard Identification Data*
- b) *Initiate Risk Assessment (Vulnerability) Data*
  Inventorying each Mapped Risk area *(Hazard by Hazard, Community by Community where different)*
  - (1) GIS Data/capability
  - (2) Building Counts, by type of use, occupancy, construction
  - (3) Estimated Values of those structures, local assessor data
  - (4) Past Loss Data, as an indication of potential future losses
  - (5) Insurance Data
  - (6) Identification of Risk Areas not mapped
  - (7) Critical Facilities
  - (8) Natural & Cultural Resources
    - (a) Wetlands, Natural Areas, Endangered Species Habitat
    - (b) Historic Districts, Structures
  - (9) Development Trends
- c) *Initiate Existing Mitigation Capability Assessment*
  - i) Identify other programs
    Other Special Districts?
  - ii) Identify other community Goals
    Updated Comprehensive Plan elements
  - iii) Collect existing policy/program guidance
    - (1) Zoning/FPM Ordinance
    - (2) Building Codes (Wind, wildfire, BCEGS rating?)

(3) Existing Emergency Management (Warning, Evacuation, EOC, LEPC, Utilities response Plan)
(4) Other

8. Questions

9. Adjourn

HAZARD MITIGATION PLANNING COMMITTEE

MEETING #2

11:00 AM, October 26, 2004

Meeting Minutes

In Attendance:

Hazard Mitigation Planning Committee Members:

Philip K. Brown	City of Fredericksburg
Kerry Maloney	Spotsylvania County
Rie Goss	Spotsylvania County
Mark Bledsoe	City of Fredericksburg
Edward Fuzy	County of Caroline
Wendy Shepherd	King George County
Brian Wolfe	Rappahannock Electric Coop
Dean Gossett	Dept. of Environmental Quality
Bruce Sterling	VDEM
Doug Boggs	Spotsylvania Co. Fire, Rescue, and Emergency Systems
Jeron Hayes	NOW Wet Area Dahlgren, VA/PAO
Joe Saitta	Rappahannock Area Health District
Eddie Allen	City of Fredericksburg
Ray Ocel	City of Fredericksburg

Consultants:
Doug Moseley Celia Prentice Kristen Kilby

Agenda and Discussion:

Welcome and Background

Doug Moseley, of AMEC Earth & Environmental, Inc. welcomed the committee members and opened the floor for new committee members to introduce themselves and the agency/entity represented. Upon completion of the committee introductions, Mr. Moseley discussed the meeting's agenda and led the committee through a PowerPoint presentation on the All Hazard Mitigation Planning Process and the upcoming steps in the plan's development.

For the benefit of those members in attendance for the first time, Mr. Moseley reviewed the RADCO All-Hazard Mitigation Plan (HMP) development process. Mitigation as defined, is any sustained action taken to reduce or eliminate long-term risk to human life and property from hazards. He noted that FEMA now promotes pre-disaster mitigation initiatives and policies, as pre-disaster mitigation appears to be more cost effective than waiting for a disaster to strike before acting. The benefits are recognized in future

losses avoided. Many natural hazard events are predictable and repetitive, and as such, loss reduction activities can be undertaken to mitigate damage. He then briefed the committee members present on some of the differences in approach that may be needed in addressing so-called "human-caused" hazards in the plan. He shared a general outline of the risk assessment with the committee, with emphasis on the methodology to be used for establishment critical facilities. The HMP will follow a ten-step process within a four-phase set of FEMA guidelines. With the invitation of new committee members and the inclusion of new constituencies, the first phase, which is driven by the organization of resources and planning for community participation, has been completed. The next phase involves the development of a risk assessment for each of the RADCO region's communities.

Hazard Identification Review

Mr. Moseley introduced new information on the natural hazards identified for the area. He detailed what questions need to be answered in the hazard ID process for plan compliance. He then discussed each natural hazard that could affect the RADCO area. The consulting staff passed out draft Hazard Identification reports to the committee members that provided an overview of each of the natural hazards that could potentially impact the region. The committee will read and review the material and offer any amendments to the summaries they see appropriate. Mr. Moseley then opened the floor for ideas from the committee that would include "other hazards" that were not discussed. The committee asked about dam failure and whether it constitutes a man-made or natural hazard and how that information would be handled in the plan. Mr. Moseley noted that it could be either and suggested looking at the analysis that the U.S. Army Corps of Engineers has performed on dam failure for reference. He also noted that the dam's purpose may be a good indicator as to how it should be handled. A flood control dam failure may be more in line with analysis of a natural hazard whereas a power supply dam, which may or may not have an impact on flood control, may be better addressed in a man-made hazard scenario.

The consulting staff then distributed a brief report containing some general information on the human caused hazards identified in the area to date. Mr. Moseley defined the data needed for the human caused section of the report. He also discussed the difference between what is considered a terrorist incident as opposed to a technological incident, as defined by FEMA guidance. Mr. Moseley showed a slide that introduced all the critical facilities for the RADCO area and opened the floor for the committee to address other facilities that need to be added to the list for further follow up. Mr. Moseley informed the committee of the EPA mandate for a Water Plant Vulnerability Assessment that would need to be completed by 2006. The DEQ representative present at the meeting explained that he had access to a KEDS database and could provide data on several facilities in the RADCO area to AMEC.

The committee recognized that AMEC needed to add other facilities to the list as possible human caused hazard targets or locations. They include:

- Schools
- Anderson Oil (Fredericksburg, Va.)
- Southern States (Fredericksburg, Va.)
- Mary Washington Hospital
- Local Government – 911 centers and EOC sites
- Electrical facilities – Dominion power sub stations
- Cell phone towers/Utilities
- Fire/Rescue towers- communication sites
- Water Tanks
- Historical Sites
- Bulk Storage facilities –local DEQ clean up sites

Mr. Moseley noted that the additional materials and ideas listed above would be incorporated as appropriate in the revised draft of the hazard identification section or in the risk assessment portion of the plan.

To begin the risk assessment process, Mr. Moseley then asked the committee members for additional information on several aspects of the hazard identification process including areas that flood on a regular basis, community fire records, and other hazards that warrant consideration in the RADCO plan.

Finally, Mr. Moseley discussed setting goals and strategies for the risk assessment and emphasized the importance of the committee highlighting what was important for the communities once we start the mitigation strategies. Mr. Moseley closed the meeting with a few key issues for next the meeting. AMEC will need assessor data from each of the jurisdictions and AMEC will provide the committee with the first draft of the Hazard Identification-Risk Assessment (HIRA) at its next scheduled meeting. Mr. Moseley will also send out an electronic version of the capabilities assessment for each committee member. The next meeting of the HMPC is scheduled for Tuesday, November 16, 2004 from 11AM to 1PM at the RADCO office conference room.

HAZARD MITIGATION PLANNING COMMITTEE

MEETING #3

11:00 AM, November 30, 2004

Meeting Agenda

1. Introductions
Complete Sign-In Roster

2. Update on Status of the Planning Process

3. Hazard Identification and Risk Assessment (HIRA)

3.1 First Draft Document for Natural Hazards
- a) Sections for Introduction, Regional Profiles, and Planning Process
- b) HIRA drafted for each jurisdiction based on available data, includes
  - i. Identified Hazards (Critical and Non-Critical)
  - ii. Vulnerability Assessment (Process)
  - iii. Existing Mitigation Capabilities
- c) Outstanding Data Collection Needs

3.2 First Draft Document for Man-Made Hazards
- a) Developed as an appendix to the All-Hazards Plan
- b) Breaks down technological and terrorist hazards by community
- c) Towns of Bowling Green and Port Royal are addressed in Caroline County section
- d) Outstanding Data Collection Needs (Matrices)

4. Schedule Update

4.1 Comments on the First Draft material (Natural and Man-Made) back to AMEC by Friday, December 10, 2004.

4.2 December 10, 2004 – Cutoff date for receipt of any new data.

4.3 Revised HIRA draft to be returned to RADCO jurisdictions and VDEM for initial review by Friday, December 17, 2004.

4.4 Planning for introduction of the revised HIRA drafts to each community's Planning Commission at the first regularly scheduled meeting in January 2005, with open public comment period.

All documents can be downloaded from the project FTP web site at:

Members of the Planning Committee that would like to offer amendments or make edits/comments to the document electronically will find a password protected Microsoft Word® version of both draft documents has been posted to the FTP site. Please contact a member of the AMEC team for the password. An Adobe .pdf version of both documents is also available on the FTP for faster downloading and printing.

HAZARD MITIGATION PLANNING COMMITTEE

MEETING #3

11:00 AM, November 30, 2004

Meeting Minutes

In Attendance:

Hazard Mitigation Planning Committee Members:

Philip K. Brown	City of Fredericksburg
Kerry Maloney	Spotsylvania County
Mark Bledsoe	City of Fredericksburg
Edward Fuzy	County of Caroline
Wendy Shepherd	King George County
Bruce Sterling	VDEM
Doug Boggs	Spotsylvania Co. Fire, Rescue, and Emergency Systems
Joe Saitta	Rappahannock Area Health District
Ray Ocel	City of Fredericksburg
John Rayman	Dominion North Anna Power Station
Mary Durrance	Stafford County Planning
John Howe	Virginia Coop Extension
Dan Stamp	Virginia Department of Forestry
Tom Snoddy	Virginia Department of Forestry
Lisa Krajewski	Virginia Department of Forestry
Karen Snape	Virginia Department of Forestry
Matt Stafford	Caroline County

Consultants:

Doug Moseley Celia Prentice Chris Stone

Agenda and Discussion:

Welcome and Background

Doug Moseley, of AMEC Earth & Environmental, Inc. welcomed the committee members and opened the floor for new committee members to introduce themselves and the agency/entity represented. Upon completion of the committee introductions, Mr. Moseley discussed the meeting's agenda and updated the committee on the work that AMEC had completed to date.

Mr. Moseley handed out the draft Natural Hazards HIRA and walked the committee through the organization of the document. He discussed several key points of comprehension, including the definition of critical versus non-critical hazards.

Mr. Moseley then passed out the Human-Caused HIRA and walked the committee through the organization of this document. Mr. Stone passed out the Vulnerability Assessment Matrices (VAM) to the appropriate community officials and discussed the role that the VAM will play in the development of the Human-Caused Hazard Mitigation Plan.

Mr. Moseley then updated the committee on the data that still need to be collected and set a date of December 10, 2004 as the cut-off data for the receipt of new data. At the request of Mr. Stephen Manster, any community unable to meet the December 10 deadline will at least contact AMEC by December 10 to let them know that additional data is forthcoming.

The date for the next HMPC meeting was set for January 13, 2005, at which time the committee will engage in a facilitated process to develop mitigation goals and objectives.

Upon concluding the meeting, AMEC staff assisted the several community officials in revising the VAM for their respective communities.

HAZARD MITIGATION PLANNING COMMITTEE

MEETING #4

11:00 AM, January 13, 2005

Meeting Agenda

1. Introductions
   Complete Sign-In Roster

2. Update on Status of the Planning Process

3. Overall Project Review

   3.1 HIRA
   3.2 Vulnerability Assessment
   3.3 Existing Mitigation Capabilities
   3.4 Outstanding Data Collection Needs

4. Facilitated Exercise for the Development of Mitigation Goals and Objectives

5. Schedule Update and Adjustments

   5.1 Revised HIRA draft was submitted to RADCO staff on Wednesday, December 22, 2004.
   5.2 AMEC staff now working through RADCO comments, with planned release of revised HIRA draft to RADCO jurisdictions by January 31, 2005.
   5.3 AMEC staff introducing Hazard Mitigation Planning process and HIRA draft findings to each community's Planning Commission at a January 2005 meeting.
   5.4 Planning for a two-week Open Public Comment period on draft HIRA, to commence shortly after submission of revised HIRA to RADCO jurisdictions.
   5.5 Schedule for next meeting on Mitigation Strategies.

No later than January 31, 2005, the document and the related attachments can be downloaded from the project FTP web site at:

Members of the Planning Committee that would like to offer amendments or make edits/comments to the document electronically will find a password protected Microsoft Word® version of both draft documents (natural and man-made) has been posted to the FTP site. Please contact a member of the AMEC team for the password.

An Adobe .pdf version of both documents will also be available on the FTP for faster downloading, printing, and for posting to community web sites for public review and comment.

HAZARD MITIGATION PLANNING COMMITTEE

MEETING #4

11:00 AM, January 13, 2005

Meeting Minutes

11:00 Welcome and Introductions

11:05 Setting the Stage (PowerPoint Presentation):

- Explain the purpose of creating mitigation goals and objectives:
  - Goals and objectives provide a framework for coordinating leadership and serve as a foundation for developing specific strategies.
  - The process is a requirement of DMA 2000.
- Provide a brief overview of the process:
  - Develop regional goals as a group.
  - Develop objectives in teams.
  - Report out the results of the teams and discuss as a larger group.
  - Close the loop by making sure that all of our agreed upon objectives have an associated goal.
  - Discuss what will happen to the results of today's meeting and how it feeds into the next meeting.
- Provide a primer on vulnerability and risk:
  - Five slide primer to help frame the discussion on goals and objectives.

11:20 Facilitated Discussion on Goals:

(Prior to meeting, DB and DM will put up draft goal statements and one word descriptor on walls, covered.)

- Detailed overview of goals process:
  - Each participant will be provided three 3x5 cards and will be asked to write up to three goals – short and succinct. About 5 minutes.
  - Once collected, the draft goals will be uncovered. Each goal will be placed under a goal if possible.
  - At the end of the process, DB and DM will facilitate changes to the goals based on the cards or place the cards in different buckets if they are jurisdiction-specific or are actually objectives or strategies.
  - DB and DM will work to develop goals, if possible, out of any "left overs."
  - A quick definition of goals versus objectives versus strategies – for our purposes, we will be concentrating on "regional" goals. But please feel free to note them. We'll save them, or it could turn out that your jurisdiction-specific goal is actually a regional goal.
- Ground-rules:
  - Know when consensus isn't going to happen quickly – the issue wont be tossed, but it may be a jurisdiction concern rather than a regional one.
  - We'll wordsmith it for you – worry about specific wording only if it makes a substantive difference.
  - Speak your mind, listen carefully, and be willing to be persuaded.
  - Allow each person to finish before responding.
  - Consider the region's overall needs as well as the needs of the jurisdictions that you represent.
  - Have fun and be creative.

- Facilitated goal development process:

12:10 Lunch

12:45 Facilitated Discussion on Objectives:
- Detailed overview of objectives setting process:
  - Explanation of the process for objectives, reinforcement of the definition of an objective versus a strategy.
  - Split into two groups. Each group will tackle half of the questions (about 3 each).
  - Each group appoints a spokesman – DB and DM will serve as facilitators/scribes.
  - Round robin exercise for each goal – go around in a circle with each participant giving one objective until all ideas are exhausted.
  - Facilitator helps the group identify strategies (and if it is a strategy, which objective it might fit with) and consolidate objective statements.

1:30 Report of Results and Close the Circle
- Each group reports results fully, then other team has an opportunity to comment and make suggestions.
- Close the circle by asking if there are any regional objectives that didn't have a home. Explain that while there might not be time to develop the goal today, AMEC will work to develop language after the meeting.
- Re-affirmation of jurisdiction-specific goals and objectives that will be developed with specific localities.

2:15 Wrap-Up and Adjourn
- AMEC will take the process results and send it out to the HMPC in the next week for comments and feedback.
- The second draft will be used by AMEC to develop strawman strategies in advance of the next meeting.
- The next meeting will use a process similar to today to validate, change, and enhance these strategies.

Meeting Products

1. Verification/modification of draft regional goals developed by AMEC. Consensus on new regional goals if required.

2. List of regional objectives for each of agreed upon goals.

3. List of jurisdiction specific goals and objectives, if any, for use with specific jurisdictions.

HAZARD MITIGATION PLANNING COMMITTEE

MEETING #5

11:00 AM, March 17, 2005

Meeting Agenda

1. Introductions
Complete Sign-In Roster

2. Update on Status of the Planning Process

3. Review of Mitigation Goals and Objectives

4. Facilitated Exercises for Regional Mitigation Action Items

4.1 Identify Regional Mitigation Actions based on Goals and Objectives
4.2 Prioritize Regional Mitigation Actions

5. Review Mapping for Human-Caused Hazard Evaluation

6. Schedule Next Meeting

HAZARD MITIGATION PLANNING COMMITTEE

MEETING #5

11:00 AM, March 17, 2005

Meeting Minutes

Name	Organization	Work Phone	E-mail
Mark Bledsoe	City of Fredericksburg	540-372-1059	mbledsoe@fd.fredericksburg.va.gov
Edward Fuzy	County of Caroline	804-633-9831	efuzy@co.caroline.va.us
Wendy Shepherd	King George County	540-775-8574	wshepherd@co.kinggeorge.state.va.us
Ray Ocel	City of Fredericksburg	540-372-1179	rocel@fredericksburgva.gov
Mary Durrance	Stafford County Planning	540-658-4540	mdurr@co.stafford.va.co
Tom Snoddy	Virginia Department of Forestry	540-582-5742	thomas.snoddy@dof.virginia.gov
Karen Snape	Virginia Department of Forestry		karen.snape@dof.virginia.gov
Eddie Allen	City of Fredericksburg	540-372-1061	eallen@fd.fredericksburgva.gov
Eileen Tarr	Virginia Department of Emergency Management	804-897-6500	eileen.tarr@vdem.virginia.gov
Jeff Harvey	Stafford County Planning	540-658-8668	jharvey@co.stafford.va.us
Melissa Papendick	Rappahannock United Way	373-0041	mpapendick@rappahanockunitedway.org
Kyle Conboy	King George County	540-775-8558	kylec@kinggeorge.state.va
Beth Payne	RADCO	540-373-2890	bjones@fampo.state.va.us
Pat Quann	RADCO	540-373-2890	pquann@fampo.state.va.us
Stephen Manster	RADCO	540-373-2890	jmanster@fampo.state.va.us
Ric Goss	Spotsylvania Police Department	540-582-7040x658	rgoss@spotsylvania.va.us
Doug Boggs	Spotsylvania County	540-582-7037	dboggs@spotsylvania.va.us

Actions

Hazard Avoidance

Goal: Avoid the impacts of natural and man-made hazards to the greatest extent practical.

Objective: To have a regional transportation network with adequate carrying capacity.

Action 1: Investigate emergency lane/shoulder improvements for ES access on all primary roads. (Perhaps even a designated emergency lane, hospital access – Rt. 1).

Action 2: Better publicize local evacuation routes throughout the region.

Action 3: Coordinate locally with VDOT on updates to VDOT's Regional Transportation Plans.

Action 4: Facilitate discussions with neighboring regions on traffic flow for emergency service vehicles.

Objective: For all local governments to have transportation detour plans and for these plans to be coordinated at the regional level.

Action 1: Improve signage/notification capability for major roadways (511 service; AM radio). Link this capability to road closures/service interruptions regardless of service.

Action 2: Investigate engineering solutions for roadway flooding issues (jurisdiction by jurisdiction).

Objective: To avoid the hazards associated with rail transportation and rail crossings.

Action 1: Identify rail/track maintenance priorities/actions (recognizing that these are privately held.

Action 2: Develop a rail crossing inventory by community. Determine which have signs/gates/lights, etc. Also evaluate road geometry of crossings (potential sticking point).

Action 3: Investigate the feasibility of implementing grade crossing sensors to alert train operators.

Action 4: Investigate potential pedestrian hazard mitigation for rail traffic/facilities. Education issue.

Objective: To ensure that privately owned earthen dams do not present a threat to life and/or property.

Action 1: Update emergency action plans and inspections.

Action 2: Facilitate notification process for notification of downstream property owners.

Action 3: Identify the permitting status/qualifications of privately owned structures. Notify the public of dam construction permitting requirements.

Action 4: Implement dam owner education program for ongoing maintenance and permitting.

Objective: To ensure that underground storage tanks do not become a threat due to leakage or other failure.

Action 1: Enhance enforcement of underground tank removal program. Improve the sampling/tracking process for sampling.

Action 2: Evaluate local tank closure process; revise as necessary; publicize proper tank closure procedures and due diligence process. Investigate incentive program to encourage positive tank management (cost sharing/grants). Incentives to oil providers to help locate tanks.

Action 3: Ensure that company-owned above ground storage tanks are properly anchored (floodprone) and that tanks are properly maintained (no leaf litter for fire hazard).

Objective: To manage the land in a way that avoids the potential for wildfires.

Action 1: Tank management.

Action 2: Promote FIREWISE construction, landscaping techniques with HOAs.

Action 3: Educate the public on rules, regulations and programming to minimize fire risk. Advise of potential fines and penalties.

Action 4: Investigate implementation of appropriate setbacks from "urban/rural" interface to reduce fire risk.

Objective: To locate incompatible land uses, structures, and critical facilities away from geologically sensitive or floodprone areas.

Action 1: Identify appropriate slope criteria and determination methods to evaluate potential for slope-related hazards. Start on a pilot basis.

Loss Reduction

Goal: Minimize losses incurred from those hazards that cannot be avoided.

Objective: To maintain intergovernmental cooperation and communication during and after a disaster.

Objective: To reduce repetitive flooding losses.

Objective: To identify specific flood mitigation opportunities/options prior to flood events, including those related to critical facilities and individual residents/businesses.

Objective: To maximize community participation in the Community Rating System (CRS).

Objective: To mitigate the impact of any development that is allowed in floodplain.

Recovery

Goal: Reduce overall impacts of hazards by facilitating timely and orderly recovery.

Objective: To integrate post-disaster strategies with pre-disaster mitigation plans.

Action 1: Review comprehensive plans to designate targeted areas where low density development should be triggered after a declaration of emergency. Identify areas within hazard areas that are non-conforming/non-compatible land uses.

Action 2: Revise locality zoning ordinances to encourage low-density development in hazard areas post-disaster.

Objective: To improve response coordination with federal partners.

Action 1: Create a Joint Information Center for RADCO. A Coordination Committee will run parallel to EMS.

Action 2: Implement a National Incident Management System (NIMS) in each jurisdiction. Will use incident command.

Objective: To protect critical facilities from hazards that could incapacitate their ability to function during an emergency, particularly flooding.

Action 1: Identify all critical facilities.

Action 2: Identify priorities for protection.

Action 3: Identify methods for protection against current and future hazards.

Action 4: Identify funding sources to protect critical facilities.

*Action 5: G*overnment ordinance or property owner for $$ (Public critical facilities, private critical facilities). **Chris, do you remember what they were talking about here?**

Efficient Use of Tools and Resources

Goal: Maximize the impact of public resources through effective coordination and the efficient use of technology.

Objective: To ensure that the region has access to the data/mapping needed to make good decisions.

Action 1: Set up a data/mapping clearinghouse within RADCO. Gather resources for all types of technology (GIS, CAD).

Action 2: Establish a minimum level of GIS data for each locality. Must have compatible data standards.

Action 3: Establish regional mapping standards (scale, legend, etc).

Action 4: Facilitate compatible communications between localities by establishing an emergency radio standard frequency.

Action 5: Eliminate radio communication gaps in valleys.

Objective: To reduce redundancy in data collection at the state and local levels.

Action 1: Create a data clearinghouse for RADCO.

Action 2: Use existing federal and state data whenever possible.

Action 3: Create a spatial analysis dataset of shared critical facilities, such as fire hydrants and communication towers.

Action 4: Extend data gathering beyond the RADCO boundaries; hazards may cross political boundaries.

Engaged Public

Goal: Empower the public to avoid hazards and their impacts and to meaningfully participate in the hazard mitigation process.

Objective: To personalize potential hazards by targeting education efforts to citizens in specific high risk groups.

Action 1: Create an education program targeted at high risk audiences such as assisted living communities, mobile home parks, and HOAs. The program should gauge the risks for each respective group.

Action 2: Identify high risk groups by reviewing Comprehensive Plans.

Action 3: Use existing educational materials created by other agencies (Planning Department, FEMA, VDEM, VDOF) to reach target groups.

Action 4: Use the Public Information Officer (PIO) to create messages for high risk groups.

Action 5: Use Public Service Announcements to reach high risk groups.

Objective: To associate voluntary mitigation with saving money in the long term.

Action 1: Identify private critical facilities and inform them of pre-disaster mitigation strategies.

Action 2: Identify public critical facilities in floodplains and other hazard areas. Educate people who live in these areas.

Action 3: Identify and present pre-disaster mitigation data to specific sites.

Action 4: Consider incentives, such as a tax abatement policy or a tax district, for mitigation efforts in each RADCO locality.

Objective: To provide citizens with general information about how to be prepared for the most common hazards.

Action 1: The Economic Development office should send disaster-related information to new homeowners.

Action 2: Utilize general media sources, including direct mailings/newsletters.

Action 3: Create a disaster information package for businesses and their employees to reduce economic losses.

Action 4: Use existing hazard related documents and distribute them to the public.

Action 5: Create a web page with real-time emergency information.

Action 6: Include disaster information on utility bills for homeowners.

Action 7: Hold an annual conference to describe hazard mitigation techniques for residents. Seek local business sponsorship for this conference and distribute educational materials. Conferences such as these have been used successfully in Florida prior to hurricanes.

Objective: To provide citizens with the knowledge of where to get information on how to deal with a hazard when it is imminent or in progress.

Action 1: Create an early warning system.

Action 2: Develop a "Reverse 911" phone system to alert targeted areas.

Action 3: Create and distribute refrigerator magnets with emergency contact phone numbers printed on the face.

Action 4: Announce disaster information on scanners, radio, TV and the Emergency Alert System. Many residents of the RADCO region own scanners.

Action 5: Sell battery powered radios at cost to residents. Seek local business support for this action.

Objective: To encourage citizens to become more observant of potential hazards so that they can serve as an extension of local data gathering efforts.

Action 1: Promote and provide Sky-Warn classes so residents can identify and report inclement weather events.

Action 2: Promote the use of Public Works' Environmental Management System, which teaches residents how to identify HazMat releases and who to contact in response.

Action 3: Develop a "hot line" telephone number.

Action 4: Promote citizen participation in Citizen Emergency Response Training (CERT).

Action 5: Promote citizen participation in Local Emergency Planning Commission (LEPC).

HAZARD MITIGATION PLANNING COMMITTEE

MEETING #6

11:00 AM, April 15, 2005

Meeting Agenda

1. Introductions
   Complete Sign-In Roster
2. Update on Status of the Planning Process
3. Review of Critical Facilities Designations and Mapping in Progress
4. Review of Mitigation Goals and Objectives and Actions Developed to Date
5. Develop Actions for Final Goal Category – Loss Reduction
6. Facilitated Exercises for Mitigation Actions Item Prioritization
7. Schedule Next Meeting

HAZARD MITIGATION PLANNING COMMITTEE

MEETING #6

11:00 AM, April 15, 2005

Meeting Minutes

Loss Reduction

Goal: Minimize losses incurred from those hazards that cannot be avoided.

Objective: To maintain intergovernmental cooperation and communication during and after a disaster.

Action 1: Network prior to disaster events; maintain communications on a regional level.

Action 2: Develop intergovernmental memorandums of understanding (MOU) at the local level, other than Virginia Mutual Aid Agreement (MAA).

Action 3: Local cooperation with the newly developed regional state agency teams as coordinated by VDEM.

Action 4: Investigate the feasibility of establishing one radio frequency for all departments in the local community (i.e. Spotsylvania County's 800 mhz signal)

Objective: To reduce repetitive flooding losses.

Action 1: Low to no interest loans as incentives for property owners that have no viable alternatives to residing in the floodplain.

Action 2: Identify local or regional partnerships that can assist in the physical relocation of homes out of the floodplain, especially where historically significant structures are concerned.

Objective: To identify specific flood mitigation opportunities/options prior to flood events, including those related to critical facilities and individual residents/businesses.

Action 1: Update community Flood Insurance Rate Maps (FIRMs)

Action 2: Educate the public, including residents and businesses, located in the floodplain on the benefits of flood mitigation, including the potential financial benefits of proactive floodplain management and flood insurance.

Action 3: Require 110% compensatory storage for projects that require the placement of fill in the floodplain.

Action 4: Eliminate the 1% "loophole" in the Virginia Erosion and Sediment Control standards relating to down stream impacts of site development (MS-19).

Action 5: Develop local ordinances prohibiting new development in the floodplain.

Action 6: Establish a special tax district that would provide an added tax for residents in the floodplain based on the increased cost of responding to flood emergencies in the floodplain.

Action 7: Purchase development rights in the floodplain.

Action 8: Amend the local floodplain management ordinance substantial damage language to include the cumulative substantial damage clause.

Action 9: Develop sub-basin master plans for water quantity to establish baselines of service from local engineering and public works agencies.

Action 10: Amend the local floodplain ordinance to require that all new development in the floodplain have its first finished floor at the Base Flood Elevation plus one foot or more.

Objective: To maximize community participation in the Community Rating System (CRS).

Action 1: Educate the community on the potential benefits of CRS program participation, including potential reductions in flood insurance premiums.

Action 2: Educate the local insurance industry on the potential benefits of CRS program participation.

Action 3: Maximize local participation in the National Flood Insurance Program (NFIP).

Objective: To mitigate the impact of any development that is allowed in floodplain.

Action 1: Require that all new construction in the floodplain have the first finished floor elevated to the Base Flood Elevation (BFE) plus one foot or more.

Action 2: Implement Best Land Use Practices for property in the floodplain (i.e. natural and beneficial uses, open space, recreation facilities, etc.)

Action 3: Assess the feasibility of adding additional stream gauges on the Rappahannock River upstream of the City of Fredericksburg to enhance warning times for river swelling and cresting.

Action 4: Assess available floodproofing opportunities on structures that are allowed the option under NFIP regulations (i.e. non-residential structures).

Multi-Objective Management

Goal: Reduce overall impacts of hazards through the implementation of multi-objective hazard mitigation and management activities.

Objective: To integrate post-disaster strategies with pre-disaster mitigation plans.

Action 1: Review comprehensive plans to designate targeted areas where low density development should be triggered after a declaration of emergency. Identify areas within hazard areas that are non-conforming/non-compatible land uses.

Action 2: Revise locality zoning ordinances to encourage low-density development in hazard areas post-disaster.

Objective: To improve response coordination with federal partners.

Action 1: Create a Joint Information Center for RADCO. A Coordination Committee will run parallel to EMS.

Action 2: Implement a National Incident Management System (NIMS) in each jurisdiction. Will use incident command.

Objective: To protect critical facilities from hazards that could incapacitate their ability to function during an emergency, particularly flooding.

Action 1: Identify all critical facilities.

Action 2: Identify priorities for protection.

Action 3: Identify methods for protection against current and future hazards.

Action 4: Identify funding sources to protect critical facilities.

Action 5: Public education – outline the $ savings for pre-disaster protection on critical facilities.

HAZARD MITIGATION PLANNING COMMITTEE

MEETING #7

11:00 AM, May 19, 2005

Meeting Agenda

1. Introductions
   Complete Sign-In Roster
2. Update on Status of the Planning Process
3. Review of Regional Mitigation Priorities
4. Facilitated Exercise to Develop Community Specific Mitigation Actions
5. Update on Human-Caused Hazard Mapping
6. Schedule Next Meeting

HAZARD MITIGATION PLANNING COMMITTEE

MEETING #7

11:00 AM, May 19, 2005

Meeting Minutes

General committee discussion of the projects:

- Hurricanes
  - Roves of fire and rescue houses
  - Downed trees can block access to fire and rescue houses
  - Debris removal issues
    - Develop a debris removal plan (road clearing plan) – similar to a snow removal plan
- Tornadoes
  - Build tornado bunkers for manufactured home parks

Breakout Discussion – King George and Caroline (represented by Stephen Manster)

- Drainage problems in the Towns
  - Recognition by VDOT
  - Urban flooding issues – back up of culverts

- Debris removal program
  - Major roads cleared first
  - Smaller roads are the problem
  - ID roads of concern
  - ID hazard trees
  - Communication network to ID areas hit the hardest

- Incentives for builders to require safe rooms and generators

- Flood Mapping
  - Coastal analysis
  - Coastal planning

- Anchoring of manufactured homes
  - State building code
  - Education/outreach to mobile home residence
  - Biggest mobile home issue is fire

- Port Royal
  - Town is registered as a historic town
  - 47 structures built in 18th century
  - 3 structures built in 19th century
  - 50 mobile homes

- Bowling Green
  - Drainage issues
  - Debris issues
  - Need GIS

Human-Caused Hazards

- Government facilities away from industrial
  - Recently built a school near an industrial facilities with hazardous materials
- Inter governmental memos of understanding
- Hardening of critical facilities

Spotsylvania/Stafford County Actions

(Hazard Avoidance, Objective 1, Action 7)

Recommended Action Item: Improve signage along major interstates and thoroughfares. The interactive signs, operated by VDOT, can be programmed to provide hazard warnings, including weather reports during tornado and hurricane events, road closings and blockages. The signs can also alert motorists to call 511 for road conditions, or to tune their radios to the emergency radio station for up-to-date conditions. These scrolling signs are needed on I-95, Routes 17, 1, 610, and 3.

Issue/Background Statement: Many motorists in the RADCO region are commuters or tourists who may be unaware of impending local weather conditions. These signs will direct them to alternative routes and will provide valuable travel and road condition information.

Responsible Office/Person: Coordinate with VDOT

Priority: Will be discussed via conference call

Schedule: Will be discussed via conference call

City of Fredericksburg

Item #1

(Loss Reduction, Objective 3, Action 1)

Recommended Action Item: Update the City's Flood Insurance Rate Maps (FIRMs)

Issue/Background Statement: The FIRMS that the City currently uses contain outdated information.

Responsible Person/Office: Will be discussed via conference call

Priority: High

Schedule: Within the next two years

HAZARD MITIGATION PLANNING COMMITTEE

MEETING #8

11:00 AM, September 15, 2005

Meeting Agenda

1. Introductions

2. How did we get here?

3. Revised Schedule – Natural Hazards Mitigation Plan

3.1 Sept. 12-16th – Final Data Collection
3.2 Sept. 19-23rd – Report revision / data incorporation
3.3 Sept. 26-30th – Final technical edits / mapping updates
3.4 Sept. 30th – Final Draft submitted
  a) To VDEM
  b) To Coordinating and Planning Committees
  c) To public (web-posting and other distribution)
  d) Announce upcoming public meetings
3.5 Oct. 31 – Nov 4th – Public Meetings and Final Committee Mtg
  All comments due by Nov 4th
3.6 Nov. 30th – Incorporate all additional comments / Final Plan
  Submit to VDEM
3.7 Jan 6th – VDEM submits to FEMA
3.8 Feb 1st – RADCO announces public hearing/adoption for early March

4. Revised Schedule – Man-Made Hazards Mitigation Plan
4.1 Oct. 11th – Final Draft submitted to RADCO
4.2 Nov. 14th – Final Comments from RADCO due
4.3 Dec. 9th – Final Version submitted to RADCO

5. Hazard Identification

5.1 Review/confirm/edit hazard priority list
5.2 Review how past events have affected each community
5.3 Review critical facility definition – narrow down

6. Relationship – Hazard ID - Vul/Cap - Goals - Measures

7. Mitigation Action Items - Breakout Groups

7.1 Example Mitigation Action Items
7.2 Confirm all recommended action items
7.3 Add recommended action items if needed

Fill in the blanks on recommended action items

HAZARD MITIGATION PLANNING COMMITTEE

MEETING #8

11:00 AM, September 15, 2005

Meeting Minutes

1. Attendance

The DMA planning regulations and guidance ardently stress that each local government seeking the required FEMA approval of their mitigation plan must participate in the process. The Coordinating Committee is comprised of RADCO staff, local emergency management staff, and local planning staff. The following members attended the meeting:

Attendee	Agency / Company	Phone	E-mail
Doug Boggs	Spotsylvania Emergency Services	540-582-7037	dboggs@spotsylvania.va.us
Wendy Shepherd	King George Emergency Management	540-775-8575	wshepherd@co.kinggeorge.state.va.us
Phil Brown	Fredericksburg Graphics	540-372-1023	pbrown@fredericksburg.va.gov
Mark Bledsoe	Fredericksburg Emergency Management	540-372-1059	mbledsoe@fd.fredericksburg.va.gov
Eddie Allen	Fredericksburg Emergency Management	540-372-1061	eallen@fd.fredericksburg.va.gov
Ray Ocel	Fredericksburg Planning	540-372-1179	rocel@fredericksburg.va.gov
Jeff Harvey	Stafford Planning	540-658-8673	jharvey@co.stafford.va.us
Stephen Manster	RADCO	540-373-2890	smanster@fampo.state.va.us
Beth Payne	RADCO	540-373-2890	bjones@fampo.state.va.us
AMEC			
Cindy Popplewell		615-333-0630	cynthia.popplewell@amec.com
Celia Prentice			
Curt Ostradka			
Leigh Morgan			

2. How did we get here?

A brief description of the change in AMEC project management and the current project status was presented to the committee members.

3. Revised Schedule

A revised schedule was developed for both the Natural Hazards Mitigation Plan and the Man-Made Hazard Plan. The revised schedules are presented below.

NATURAL HAZARDS MITIGATION PLAN SCHEDULE

a. Sept. 12-16th – Final Data Collection
b. Sept. 19-23rd – Report revision / data incorporation
c. Sept. 26-30th – Final technical edits / mapping updates
d. Sept. 30th – Final Draft submitted
   a) To VDEM
   b) To Coordinating and Planning Committees
   c) To public (web-posting and other distribution)
   d) Announce upcoming public meetings
e. Oct. 31 – Nov 4th – Public Meetings and Final Committee Mtg
   All comments due by Nov 4th
f. Nov. 30th – Incorporate all additional comments / Final Plan
   Submit to VDEM
g. Jan 6th – VDEM submits to FEMA
h. Feb 1st – RADCO announces public hearing/adoption for early March

MAN-MADE HAZARDS MITIGATION PLAN SCHEDULE

a. Oct. 11th – Final Draft submitted to RADCO
b. Nov. 14th – Final Comments from RADCO due
c. Dec. 9th – Final Version submitted to RADCO

4. Hazard Identification

i. Review/confirm/edit hazard priority list
Each community reviewed the existing priority list of hazards for that community. The priority lists were revised as needed.

j. Review how past events have affected each community
Each community spent 25 to 30 minutes writing a summary of past hazard events and the effects upon each community. This will be incorporated to the hazard identification section of the plan.

k. Review critical facility definition
The definition of critical facilities for use in the hazard mitigation plan was pared down to include EOC/911, police, fire, power, water, wastewater, shelters, and communication.

5. Relationship – Hazard ID - Vul/Cap - Goals – Measures

A brief description of Goals, Objectives, and Activities was reviewed. Several examples were presented such as:

l. Hazard – Spotsylvania has identified several wildfire hazard areas.
m. Goal – To reduce future impact and losses from wildfires.
n. Objective – Protect new development in the identified wildfire hazard areas.
   o. Action Item – Require FIREWISE principles in the subdivision ordinance such as roadway widths and vegetation restrictions.

6. Mitigation Action Items

Prior to the meeting, the goals and objectives developed by the Committee for the draft plan were simplified and reorganized. Objectives were added based upon the Hazard Identification. Existing action items developed by the Committee were reorganized to coincide with the re-aligned goals and

objectives. Action items were also added based upon the Hazard Identification. All action items were identified as either regional or individual actions.

During the meeting, the committee members discussed the re-aligned goals and objectives, agreed upon the regional action items, and selected the individual action item that applied to their community. Data was then collected from each community to develop the individual action item.

7. Next Meeting

Public Meetings within each community and a final Coordinating Committee meeting are scheduled for the first week of November (October 31st through November 4th).

8. Meeting Handouts

The following documents were utilized during the meeting and are included as attachments to the Meeting Minutes:

- Presentation Slides
- Original Goals – Objectives – Action Items
- Original Action Items
- Revised Goals – Objectives – Action Items

HAZARD MITIGATION PLANNING COMMITTEE

MEETING #9

11:00 AM, December 15, 2005

Meeting Agenda

1. Introductions
Complete Sign-In Roster

2. Update on Status of the Planning Process

3. Revised Schedule – Natural Hazards Mitigation Plan

4. Review Comments from Public; Public Meetings; and Planning Committee

HAZARD MITIGATION PLANNING COMMITTEE

MEETING #9

11:00 AM, December 15, 2005

Meeting Notes

Attendee	Agency / Company	Phone	E-mail
Doug Boggs	Spotsylvania Emergency Services	540-582-7037	dboggs@spotsylvania.va.us
Wendy Shepherd	King George Emergency Management	540-775-8575	wshepherd@co.kinggeorge.state.va.us
Mark Bledsoe	Fredericksburg Emergency Management	540-372-1059	mbledsoe@fd.fredericksburg.va.gov
Ray Ocel	Fredericksburg Planning	540-372-1179	rocel@fredericksburg.va.gov
Jeff Harvey	Stafford Planning	540-658-8673	jharvey@co.stafford.va.us
Stephen Manster	RADCO	540-373-2890	smanster@fampo.state.va.us
Beth Payne	RADCO	540-373-2890	bjones@fampo.state.va.us
AMEC			
Cindy Popplewell		615-333-0630	cynthia.popplewell@amec.com

1. Revised Schedule

A revised schedule was developed for both the Natural Hazards Mitigation Plan and the Man-Made Hazard Plan. The revised schedules are presented below.

NATURAL HAZARDS MITIGATION PLAN SCHEDULE

a. Sept. 12-16th – Final Data Collection
b. Sept. 19-23rd – Report revision / data incorporation
c. Sept. 26-30th – Final technical edits / mapping updates
d. Sept. 30th – Final Draft submitted
   a) To VDEM
   b) To Coordinating and Planning Committees
   c) To public (web-posting and other distribution)
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   All comments due by Nov 4th
f. Nov. 30th – Incorporate all additional comments / Final Plan
   Submit to VDEM
g. Jan 6th – VDEM submits to FEMA
h. Feb 1st – RADCO announces public hearing/adoption for early March

2. Next Meeting

Public Meetings within each community and a final Coordinating Committee meeting are scheduled for the first week of November (October 31st through November 4th).

3. Meeting Handouts

The following documents were utilized during the meeting and are included as attachments to the Meeting Minutes:

- Presentation Slides
- Original Goals – Objectives – Action Items
- Original Action Items
- Revised Goals – Objectives – Action Items

HAZARD MITIGATION PLANNING COMMITTEE CORRESPONDENCE

The Hazard Mitigation Planning Committee contacted the following neighboring communities and academic institutions directly, to provide the opportunity for review and comment on the plan:

- University of Mary Washington.
  Rick Hurley, Executive Vice President

- Culpepper County
  E. Thomas Williams
  Coordinator/Hazardous Materials Coordinator

- Essex County
  Larry E. Smith
  Coordinator/Hazardous Materials Coordinator

- Fauquier County
  Philip Myer
  Coordinator/ Hazardous Materials Coordinator

- Hanover County
  Fred Crosby
  Hanover Fire-EMS

- King William County
  Steve E. Puckett
  Coordinator/ Hazardous Materials Coordinator

- King and Queen County
  John Douglas Fogg
  Coordinator/ Hazardous Materials Coordinator

- Louisa County
  Michael E. Schlemmer
  Coordinator/ Hazardous Materials Coordinator

- Orange County
  R. Duff Green
  Coordinator

- Prince William County
  Patrick M. Collins
  Coordinator

- Westmoreland County
  Norman Risavi
  Coordinator

Sample correspondence is presented on the following page.

M E M O R A N D U M

TO: Rick Hurley, Executive Vice President

FROM: Cynthia Popplewell, P.E.
AMEC

DATE: February 14, 2006

SUBJECT: RADCO All-Hazards Mitigation Plan

RADCO All-Hazards Mitigation Plan

The Rappahannock Area Development Commission retained AMEC Earth & Environmental, Inc. (AMEC) to assist with the facilitation and development of the region's All-Hazards Mitigation Plan. The RADCO region, aligned geographically with the Fredericksburg area, is located in northeastern Virginia and includes the City of Fredericksburg and the Counties of Caroline (including the Towns of Bowling Green and Port Royal), King George, Spotsylvania and Stafford.

In an effort to provide an opportunity for neighboring communities, businesses, academia and other private and non-profit interests to be involved in the planning process of the RADCO All-Hazards Mitigation Plan, we have placed the plan on an FTP site for your review and comment.

Site: ftp1.na.amec.com
Username: 2radco
Password: 2radco2006

- Nat_Haz_Rpt_Jan_2006_1.0 - 3.0
- Nat_Haz_Rpt_Jan_2006_4.0 - HAZARDS_REGIONAL
- Nat_Haz_Rpt_Jan_2006_4.2 - HAZARDS_INDIVIDUAL
- Nat_Haz_Rpt_Jan_2006_5.0 - VULNERABILITY
- Nat_Haz_Rpt_Jan_2006_6.0 - CAPABILITY
- Nat_Haz_Rpt_Jan_2006_7.0 - ACTIONS_REGIONAL
- Nat_Haz_Rpt_Jan_2006_7.2 - ACTIONS_INDIVIDUAL
- Nat_Haz_Rpt_Jan_2006_APPENDICES
- FOLDER - "Appendix B Maps"

Comments may be returned to AMEC via mail, fax, or email:

- Mail written comments to:
  Cynthia Popplewell, P.E. CFM
  Senior Project Manager
  AMEC Earth and Environmental, Inc.
  3800 Ezell Road, Suite 100
  Nashville, TN 37211
- Fax written comments to (615) 781-0655; or
- Email your comments to cynthia.popplewell@amec.com

Appendix B

RADCO Natural Hazard Mapping

Appendix C

Natural Hazard Ranking Sheets

Priority of Hazards

Methodology

Hazards were identified and prioritized through an exercise that was conducted with RADCO Hazard Planning Committee. In the exercise participants were asked to identify natural hazards that occur within their community and rank the selected hazards from highest to lowest priority. The results of those exercises are included in the table below. The priority hazards were determined using a combination of historical occurrences, public perception of hazard risk, and the probability of future occurrence based on other technical resources.

Prioritization of Hazards for Caroline County, Town of Bowling Green, and Town of Port Royal

Hazard	Critical vs. Non-Critical	Probability of Occurrence	References
NATURAL HAZARDS			
Biological Hazards	Critical	L	Health Dept
Dam Failures	Critical	L	
Drought	Non-Critical	L	
Earthquakes	Non-Critical	L	USGS
Expansive Soils	Non-Critical	L	NOAA-NCDC
Extreme Heat	Non-Critical	L	
Floods – Riverine/Coastal	Critical	H	FEMA, NCDC
Hurricanes	Critical	M	USGS, NOAA, VDEM
Landslides	Non-Critical	L	USGS
Nor'easters	Critical	H	FEMA, NCDC
Thunderstorm / Lightning	Non-Critical	H	NOAA-NCDC
Tornadoes	Critical	M	NCDC
Wildfires	Critical	H	VDOF
Winter Weather	Critical	H	FEMA, NCDC, VDEM
H=High; M=Medium; L=Low; N=No; N/A=Not Applicable, Unknown=Historical Data Unavailable; OEM= County Office of Emergency Management; NCDC=National Climatic Data Center; FEMA=Federal Emergency Management Agency; USGA=United States Geological Survey; MHA=Multi-Hazard Atlas			

Prioritization of Hazards for The City of Fredericksburg

Hazard	Critical vs. Non-Critical	Probability of Occurrence	References
NATURAL HAZARDS			
Biological Hazards	Critical	L	Health Dept
Dam Failures	Critical	L	
Drought	Critical	M	
Earthquakes	Non-Critical	L	USGS
Expansive Soils	Non-Critical	L	NOAA-NCDC
Extreme Heat	Non-Critical	L	
Floods – Riverine/Coastal	Critical	H	FEMA, NCDC
Hurricanes	Critical	M	USGS, NOAA, VDEM
Landslides	Non-Critical	L	USGS
Nor'easters	Critical	H	
Thunderstorm / Lightning	Non-Critical	H	NOAA-NCDC
Tornadoes	Critical	M	NCDC
Wildfires	Critical	L	VDOF
Winter Weather	Critical	H	FEMA, NCDC, VDEM
H=High; M=Medium; L=Low; N=No; N/A=Not Applicable, Unknown=Historical Data Unavailable; OEM= County Office of Emergency Management; NCDC=National Climatic Data Center; FEMA=Federal Emergency Management Agency; USGA=United States Geological Survey; MHA=Multi-Hazard Atlas			

Prioritization of Hazards for King George County

Hazard	Critical vs. Non-Critical	Probability of Occurrence	References
NATURAL HAZARDS			
Biological Hazards	Critical	L	Health Dept, OEM
Dam Failures	Critical	L	
Drought	Critical	M	OEM
Earthquakes	Non-Critical	L	USGS, OEM
Expansive Soils	Non-Critical	L	NOAA-NCDC, OEM
Extreme Heat	Non-Critical	M	
Floods – Riverine/Coastal	Non-Critical	M	FEMA, NCDC, OEM
Hurricanes	Critical	M	USGS, NOAA, VDEM, OEM
Landslides	Non-Critical	L	USGS, OEM
Nor'easters	Critical	H	
Thunderstorm / Lightning	Non-Critical	H	NOAA-NCDC, OEM
Tornadoes	Critical	M	NCDC, OEM
Wildfires	Critical	H	VDOF, OEM
Winter Weather	Critical	H	FEMA, NCDC, VDEM, OEM
H=High; M=Medium; L=Low; N=No; N/A=Not Applicable, Unknown=Historical Data Unavailable; OEM=Local Office of Emergency Management; NCDC=National Climatic Data Center; FEMA=Federal Emergency Management Agency; USGA=United States Geological Survey; MHA=Multi-Hazard Atlas			

Prioritization of Hazards for Spotsylvania County

Hazard	Critical vs. Non-Critical	Probability of Occurrence	References
NATURAL HAZARDS			
Biological Hazards	Critical	L	VDH
Dam Failures	Critical	L	VDEM, OEM
Drought	Critical	M	VDH, OEM
Earthquakes	Non-Critical	L	USGS, OEM
Expansive Soils	Non-Critical	L	NOAA-NCDC
Extreme Heat	Non-Critical	M	NOAA, OEM
Floods – Riverine/Coastal	Non-Critical	M	FEMA, NCDC, OEM
Hurricanes	Critical	M	USGS, NOAA, VDEM, OEM
Landslides	Non-Critical	L	USGS, OEM
Nor'easters	Critical	H	NOAA, OEM
Thunderstorm / Lightning	Non-Critical	H	NOAA-NCDC, OEM
Tornadoes	Critical	M	NCDC, OEM
Wildfires	Critical	H	VDOF, OEM
Winter Weather	Critical	H	FEMA, NCDC, VDEM, OEM

H=High; M=Medium; L=Low; N=No; N/A=Not Applicable, Unknown=Historical Data Unavailable; OEM=County Office of Emergency Management; NCDC=National Climatic Data Center; FEMA=Federal Emergency Management Agency; USGA=United States Geological Survey; MHA=Multi-Hazard Atlas

Prioritization of Hazards for Stafford County

Hazard	Critical vs. Non-Critical	Probability of Occurrence	References
NATURAL HAZARDS			
Biological Hazards	Critical	L	Health Dept
Dam Failures	Critical	L	
Drought	Non-Critical	L	
Earthquakes	Non-Critical	L	USGS
Expansive Soils	Non-Critical	L	NOAA-NCDC
Extreme Heat	Non-Critical	L	
Floods – Riverine/Coastal	Critical	H	FEMA, NCDC
Hurricanes	Critical	M	USGS, NOAA, VDEM
Landslides	Non-Critical	L	USGS
Nor'easters	Critical	H	
Thunderstorm / Lightning	Non-Critical	H	NOAA-NCDC
Tornadoes	Critical	M	NCDC
Wildfires	Critical	H	VDOF
Winter Weather	Critical	H	FEMA, NCDC, VDEM

H=High; M=Medium; L=Low; N=No; N/A=Not Applicable, Unknown=Historical Data Unavailable; OEM=County Office of Emergency Management; NCDC=National Climatic Data Center; FEMA=Federal Emergency Management Agency; USGA=United States Geological Survey; MHA=Multi-Hazard Atlas

Annex A

Human-Caused Hazard Mitigation Plan

The Human-Caused Hazard Mitigation plan is a confidential document. Please contact the Rappahannock Area Development Commission for permission to review this document.

Rappahannock Area Development Commission
P.O. Box 863
Fredericksburg, Virginia 22404
(540) 373-2890 (main)
(540) 899-4808 (fax)